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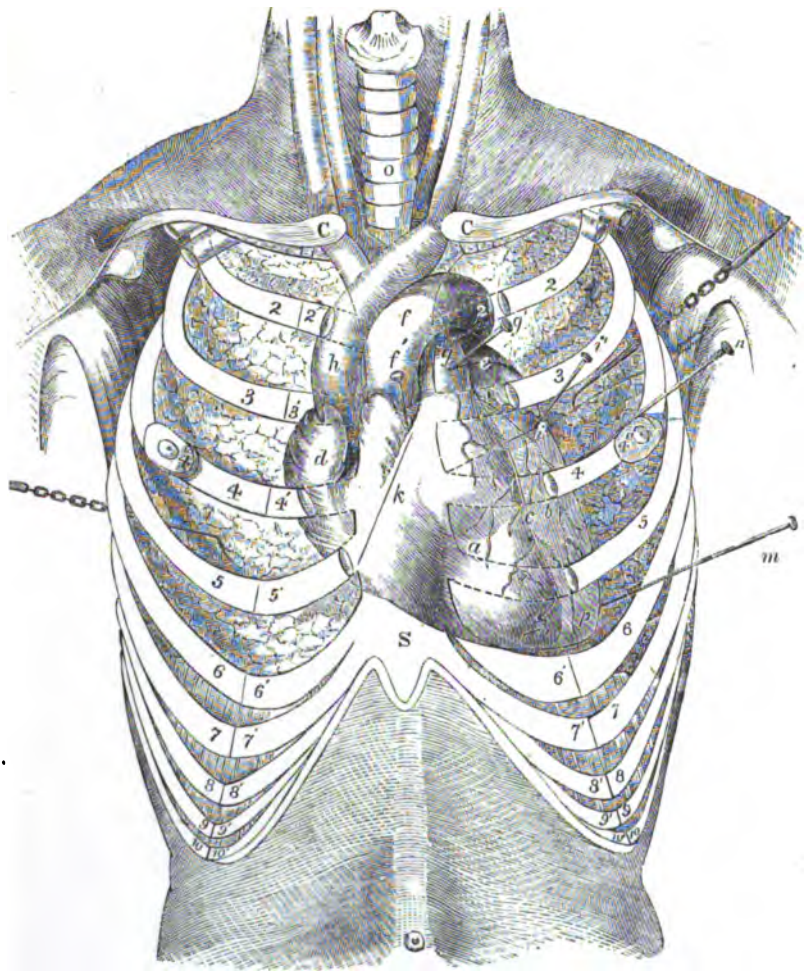
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THE

DIAGNOSIS, PATHOLOGY,

AND

TREATMENT

OF THE

DISEASES OF THE CHEST.

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BY

W. W. GERHARD, M.D.,

ONE OF THE PHYSICIANS TO THE PENNSYLVANIA HOSPITAL; FELLOW OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA; MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY, ETC.

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FOURTH EDITION, REVISED AND ENLARGED.

PHILADELPHIA:
J. B. LIPPINCOTT & CO.
1860.

Entered, according to Act of Congress, in the year 1859, by
W. W. GERHARD, M.D.,
In the Clerk's Office of the District Court of the United States, for the Eastern District of Pennsylvania.

TO

CASPAR W. PENNOCK, M.D.

My dear Pennock,—

It gives me very great pleasure to dedicate this work to you. The subject was for a long time an object of our mutual study, and must bring to your recollection the many happy hours which we spent in its pursuit. With my best wishes for the entire restoration of your health, I inscribe myself,

Yours, very sincerely,

W. W. GERHARD.

PREFACE

TO THE FOURTH EDITION.

THE present edition of this work has been thoroughly revised and carefully corrected. About one hundred pages of new matter have been added, thereby enabling me to bring it up to the actual state of our knowledge of Diseases of the Chest. I was at the same time unwilling to increase its dimensions to an inconvenient degree.

The value of a most important remedy, cod-liver oil, has, since the publication of the third edition, been subjected to the test of careful and prolonged experience by a multitude of observers. An attempt has been made to give the conclusions to which I have arrived as to the results of the therapeutic effects of the oil. These have been almost precisely similar to those which I have already published in the last edition.

Large additions have been made to Pneumonia, Pulmonary Consumption, and especially to Diseases of the Heart, the latter subject not having been sufficiently developed in the last edition.

PHILADELPHIA, *November* 4, 1859.
1206 SPRUCE STREET.

PREFACE

TO THE FIRST EDITION.

To SUPPLY the wants of his class, and of others who felt an interest in the subject, the author published, in the year 1835, a short treatise on the Diagnosis of Thoracic Diseases, embodying what was most important in reference to the physical and general signs; this manual did not include the treatment, and was found upon experience to be less complete than was desirable. At the request of many of his pupils, he published a series of lectures during the years 1840–1, in the Medical Examiner, which, with some additional lectures, were collected into the first edition of the present work.

The form of lectures in the first edition was retained as the most convenient; some of them were condensed by a careful hand from the oral lectures of the author; the greater part, however, were written by himself, forming the substance of the course. They necessarily were less full than the lectures as delivered, and the illustrations were of course excluded; but they comprised the most important parts of the subject, such as are most worthy of being remembered, and seem essential to a knowledge of the subject. In the present edition the work is divided into the usual form of chapters, arranged according to the subjects of which they treat.

Few references are made to authors; these seemed unnecessary, for the history of the diseases of the chest is so well known that there is little difficulty in determining the source from which the recent discoveries have originated. The publication of the work of Laennec, on Mediate Auscultation, gave precision to the history of a class of diseases which were before but imperfectly known; and it was soon found that the labors of this admirable observer, far from diverting attention from the study of the rational symptoms, rendered them more available for diagnosis.

Andral, if not the first to discover the bronchial respiration, was

the earliest to point out its value; but his most important labors, as regards the diseases of the chest, are the complete history which he has given of their symptoms and pathological anatomy.

The publication of the work of Dr. Louis on Phthisis was another important step in the history of pectoral diseases; it developed the pathological anatomy and symptoms much further than had hitherto been done, and rendered the diagnosis of consumption vastly more perfect. Since the publication of Dr. Louis's work, the additions made to the history of phthisis and pectoral diseases in general, have been much less important if taken singly, but in the aggregate are far from inconsiderable. The diseases of the lungs in children are much better understood, and are known to be more frequent causes of death than those of any other organ of the body; and among the affections of adults the pathology of phthisis has been studied in connection with a general diathesis, or tuberculous predisposition, and not merely as a disease limited to the lungs. The therapeutics of phthisis have advanced to some extent, but in a less degree than the natural history of the disease.

The diseases of the heart were but imperfectly known to Laennec; later investigations, especially those of Bouillaud and Hope, have added more to their pathology than had been done for almost a century before. The therapeutics of these diseases have been, perhaps, more immediately improved by recent pathological investigations than those of any other affection.

Within a few years past very good treatises on auscultation have appeared from Drs. Barth and Roger, Walsh, and others; these have, in a great degree, replaced the earlier publications of Drs. Graves and Stokes upon this subject. They do not, however, enter much into the general symptoms of diseases of the chest, but are principally confined to the physical signs.

The object of the present work is not limited to auscultation; it includes, on the contrary, the general symptoms and treatment; and I may hope that it will prove useful to those who require a publication of the kind.

PHILADELPHIA, March 10th, 1846.

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DISEASES OF THE CHEST.

DISEASES OF THE CHEST.

CHAPTER I.

INTRODUCTORY.

USES OF CLASSIFICATION IN THE STUDY OF DISEASE—COMPARISON OF PHYSICAL AND GENERAL SIGNS.

THE recognition both of primary and secondary disorders is more easy in affections of the thorax than in those of other cavities of the body, from our possessing the advantage of two distinct modes of investigation. These are the altered functions, including both those of the viscera of the thorax and of the rest of the body, and the physical signs offered by the diseased organs. The general symptoms of thoracic diseases are learned in the same way as those of other organs of the body; but the physical signs, on the other hand, are so much more applicable to chest affections than to any other disorders, that they are, in practice, with a few exceptions, used only in the diagnosis of the diseases of this cavity, and are generally described with direct reference to the chest. This peculiar fitness of the physical signs for the study of pectoral diseases depends upon the conformation of the thorax and the structure of the organs contained within it. These are important viscera,—the lungs and heart, which are organs possessing different degrees of density, and constantly in motion; so that certain sounds are produced which serve to distinguish the healthy from the diseased action. Hence we may, from the examination of the thorax, not only ascertain the density of the

organs when at rest, but we may, with great certainty, discover whether they act in a regular and natural manner, and what impediments interfere with their motion. These advantages are not offered by the viscera of any other cavity; for although the physical properties of them are sometimes sufficiently marked to enable us to detect variations in form, or in density of tissue, they are scarcely ever susceptible of sufficient motion to cause an audible sound by their own contraction, or by the passage of a fluid through their cavity. The physical signs are, therefore, chiefly adapted to the investigation of diseases of the thorax.

Physical exploration is much more extended in its application when combined and compared with the rational signs, than if used alone. For, in itself, it teaches us rather the condition of organs as modified by disease than the manner in which the disease forms, or the mode in which it advances. This is especially the case in the chronic diseases of the chest, which depend upon a general vice of the economy, for in order to distinguish disease from health, by the physical exploration of the lungs and heart, it is necessary that a change should occur in the structure of the tissue; and as this alteration is only brought about slowly and gradually, we cannot always decide whether the tissue is or is not diseased to some extent, if it be diseased in a degree not sufficient to produce an important change in the conformation of the part. There is, therefore, no means of arriving at a correct conclusion in the diagnosis of pectoral diseases other than a union of the two modes of investigation, which will then work together as two different ways of arriving at the same end. When physical exploration is properly understood, and compared with the symptoms, it will be found to be even more useful for its negative than its positive results; that is, it will be more useful as a means of showing that some diseases do not exist, or that a given disease has not arrived at a point of structural disorganization sufficient to endanger life, than as direct evidence of the mischief already done to the organs. The positive evidence derived from physical exploration is so simple and easily discovered that, after acquiring a certain familiarity with it, little attention is required to discover the full value of the signs. The negative evidence, on the other hand, is much more difficult; for

a thorough knowledge of the means of examination, and much practice in using them, are required to pronounce with certainty as to the existence of slight alterations of a part, or the absence of decided structural change. But when the necessary familiarity is acquired, the certainty of the knowledge obtained from this source is such that we may rely upon the negative evidence as confidently as upon the positive signs, especially when compared with the indications derived from general symptoms.

The great value of the negative evidence of physical exploration depends upon its certainty. The process of reasoning which renders negative evidence of value in diagnosis, is called reasoning by way of exclusion; but, although it is of great utility when skillfully applied, it is useless unless a disease is announced by positive signs when it exists, and then we may look upon the absence of these signs as a proof that it is not present. If, on the other hand, the signs themselves be doubtful, the absence of them is of course no proof that the disease does not exist; or if these signs be of such nature that we can ascertain them with extreme difficulty, they lose the advantage of serving both as negative and positive evidence.

Now, in the diseases to which physical exploration is applicable, this is not the case. The signs are, in general, very easily ascertained, and are always, under similar circumstances, the same; hence, they may be used in the way of exclusion with great confidence; that is, when they are not discovered by one who is familiar with the means of exploring them, they may be confidently said not to exist. This negative evidence, as I have already stated, is useful in two ways: first, as evidence that there is no disease at all existing; secondly, as evidence that there is no great change of structure. The first requires that the general symptoms should agree, as it were, with the physical signs, in proving the integrity, or the comparative soundness of the part. The second requires that the physical signs should be, to a certain extent, contradicted or disproven by the general symptoms. But as this seeming discrepancy is applicable only to the degree of the alteration, and not to its nature, there is, in fact, no real contradiction between the two means of examination. On the contrary, they will be found, when compared together, to accord

singularly in the principal deductions which are drawn from each of them.

The extent of application of the physical means of exploration is, perhaps, novel to many persons who are not familiar with the beautiful application of the laws of diagnosis, by way of exclusion, in which the certainty of the physical signs renders them even more useful than in other cases in which a precision approaching to mathematical correctness is required; but this very certainty may render them an occasional source of error with those who are neither accustomed to their use nor perfectly familiar with the ordinary symptoms of disease. That is, an art which is evidently based upon fixed physical laws may lead to error when the data upon which the problem of diagnosis is founded are not perfectly settled, although the process of reasoning may still be the correct one. But the abuse of a certain method of observation does not constitute a real objection to its employment; it merely proves that it is necessary to surmount the first difficulties which attend its acquisition.

The great importance of the comparison of the general symptoms and physical signs has become more apparent with the more habitual employment of physical exploration, as a really practical aid to diagnosis. The earlier writers on auscultation, especially Laennec, were rather disposed to separate physical from symptomatic diagnosis; this error depended upon the novelty of the art, and the overstrained efforts to extend its application; but as physicians became more familiar with it, and had opportunities for testing its merits, it was placed on its real footing, and regarded as more useful than any symptoms taken singly, but as neither the only class of symptoms to be relied upon, nor as superseding the general signs. We are indebted to the French pathologists for pointing out the necessity of comparison of all the symptoms of pulmonary disease, and of connecting this comparison with their succession in order. It is a subject largely insisted upon in the writings of Andral, but one which was most completely developed in the lectures of Dr. Louis. It afterwards received much attention from Dr. Stokes and others, who have occupied themselves with the study of pectoral diseases.

Although it is not at this time necessary to insist upon the

truth of the physical signs to those who are conversant with their use, their certainty may still appear questionable to a few who are not practically acquainted with them. As these signs are based upon the settled laws of physical science, and, in fact, involve some universally admitted principles, the only reason for doubting their accuracy is a want of due knowledge of the subject. But as a certain acquaintance with them is necessary to appreciate the evidence upon which they depend, I may properly enough point out what is included under the terms physical exploration and physical signs. Physical exploration includes the modes of ascertaining the changes which occur in the physical structure of organs; these changes we appreciate by the alterations of form, and by the sounds produced in the interior of the body by the motion of solids, or of elastic or non-elastic fluids, or by the resonance which is yielded by the surface when tapped or struck by the finger. This latter mode of examination obviously depends upon the different density of organs, and, in the cavity of the thorax, chiefly upon the existence of air, so that the percussion is more or less clear or dull, as the quantity of air contained within the thorax is greater or less. The alterations of form are few in number, and are readily learned; but the signs dependent upon changes in the sounds produced by the passage of air and of blood within the thorax, or the resonance of the air when thrown into motion by the act of speaking, seem comparatively difficult, and involve more complicated phenomena. The same remarks are applicable to the signs of percussion, which are not a little difficult; but, in either case, the sounds are regularly and uniformly the same under similar circumstances.

The difficulty in learning the physical signs thus consists in two distinct points: first, in the acquisition of the sounds themselves, considered as simple phenomena; secondly, in the knowledge of the condition of the organs which corresponds to these sounds. The sounds themselves require not only to be learned well enough to be understood, but they must be fixed so thoroughly in the mind that no room should be left for mistaking one for another. This demands time, attention, and organs of hearing which are not physically incapable of discriminating between sounds which at first may seem nearly similar. The first difficulty

is surmounted; there still remains the other, which requires a knowledge of many circumstances which are connected with the pathology of the disease. These are those which relate to the physical condition of the viscera, or the pathological anatomy of the parts, and to the functional action of the organs which is necessary for the production of most of the sounds. Hence, the knowledge of the physical means of exploration requires no little time and attention, and cannot be learned in a careless or hasty manner.

There is, therefore, this impediment to the study of the diseases of the chest and of physical exploration, that the act itself is a matter of difficulty, and requires more labor than is willingly bestowed upon it. The whole process of investigation requires this attention; even the manual or mechanical precautions necessary to be taken are not to be learned at the first trial, but require time in the performance of this art, like that of every other; for the ear and hand are not at first capable of the delicate and varied actions necessary for the satisfactory exploration of the thorax. But, although the apparently complex nature of physical exploration may prevent many from attempting its study, the difficulties which at first present themselves are readily enough removed by patient and laborious attention, and are more than compensated by the certainty which results from a mode of investigation based upon fixed physical laws. Every step in the acquisition of this knowledge is appreciable, and, in proportion as it becomes more accurate, the diagnosis of disease assumes a new character, which is never acquired when confined to the functional symptoms. This is true even at present, when the comparison of local and general symptoms to which I have just alluded has rendered the latter much more clear, and their value better defined. The physical signs have served as a point of departure, with which to compare the rational symptoms, and have thus rendered the latter more easy of recognition, and more positive in their relations with the internal lesions of the thorax. This is so obviously the case, that a glance at the works of any of the later writers upon the subject is sufficient to show that the rational signs have become of more practical service for the study of diagnosis than they have ever been, and that many of

these symptoms have been investigated with a care which was never before bestowed upon them. Some symptoms, it is true, have fallen into comparative neglect, because they are no longer of decided utility in diagnosis, but the greater number have derived new value from their connection with the physical signs.

As the diagnostic characters of the diseases of the chest are composed of several distinct sets of symptoms, they may be studied after each class of them has been separately learned, or the diseases themselves may be first observed, and the symptoms analyzed as they present themselves at the bedside. The former method is naturally adopted in a systematic treatise, or course of lectures; the latter belongs more properly to clinical or demonstrative medicine,—a subject of which I treat more at large in another place. As the object of the present treatise is not only to explain the mode of application of these methods of investigation to the study of disease, but to teach the methods themselves, it resolves itself naturally into two parts. The first part will contain the explanation of the physical signs, and teach the method of acquiring them which I have found most convenient for beginners. In connection with this portion of the subject, I shall treat of those functional symptoms which are immediately connected with the organs of the thorax, and are therefore most conveniently learned at an early part of the study. The second part will be devoted to the examination of individual diseases in connection with their symptoms and treatment. The series will thus comprise, as nearly as my space will permit, a complete history of the modes of exploration used in the diseases of the thorax, as well as an account of those diseases themselves.

The difficulties which attend the study of pectoral diseases depend more, however, upon an imperfect method than upon the subject itself, and may be obviated in a great degree by adopting an order which is in harmony with the natural connection of these signs. In all essential particulars they are readily understood when they are pointed out by one who is practically familiar with them; but one who is yet unpracticed becomes embarrassed when he examines a patient without the aid of an adviser. Signs which are really different are sometimes confounded together, and those which are mere varieties of the same species are thought to be

perfectly distinct. If the signs are well-characterized sounds, their discrimination should always be easy, and error would be impossible; that is, the correspondence between the sounds in certain physical conditions is necessarily exact, and the chances of error depend upon an erroneous interpretation of them. The interpretation is very different from the recognition of the sounds, and necessarily includes more data and more complicated reasoning. There can be no reason for not detecting a sound connected with the chest; it should be at least as easily recognized as the tone of voice or spoken language; it does not require any peculiar nicety of organs, or a finely cultivated musical ear, but merely a good power of discriminating sounds, and the attention necessary for observation of any natural phenomena.

I shall endeavor to arrange the physical signs in such an order as will facilitate this part of the study, and shall explain the method of acquiring them which will be found most convenient. If we content ourselves with detecting them when pointed out to us, and merely understanding the differential characters without actually knowing them, we shall gain but little, and without acquiring the knowledge of them which is practically useful. The best method of avoiding the habit of careless observation is to dwell long upon each sign at first, and afterwards connect it with others which are closely related to it, and are met with either in the same or in other patients. The whole matter will in this way be rendered singularly easy.

CHAPTER II.

CONFORMATION OF CHEST—CIRCUMSTANCES INFLUENCING IT—MODE OF EXAMINATION—MENSURATION—SUCCUSSION.

It was my object in the first chapter to prevent a frequent source of error, which often produces either an obvious or a concealed influence upon the mind. This is a desire to lay too much stress upon a single set of symptoms, to the neglect of others, and to examine a disease of a part of the body as if it were nearly or altogether unconnected with the same, or with different disorders which attack other organs and tissues. In commencing, therefore, a course of studies which are founded upon the positive evidence of anatomical lesions, and of the corresponding physical signs, I would put the reader upon his guard against too anatomical a view of the subject, too exclusive a study of lesions, and would warn him against allowing the results of disease to be confounded with disease itself; or the physical signs, which constitute the key to so many important researches, from being mistaken for actual diagnosis. It is the deductions from the whole of the physical signs and functional symptoms which constitute the diagnosis, not the naked examination of a single set of them. This may seem a matter which is too trivial to attract much notice; but in practice it is of much moment, and the errors which I have seen from a neglect of it are frequent, and very readily committed. It may seem that this is reasoning against myself, as it were, and attacking the subject upon which I lay so much stress; but in professing to give an essay on diagnosis and treatment, imperfect as it is, I am necessarily led to an enlarged study of pathology, and to the view of the subject which seems to me most consistent with facts; that is, one embracing the relation of the phenomena one to another. I am also unwilling to diminish the

value of positive observation, by drawing any inferences which the actual state of the subject will not fully warrant; this would be the case, if, at the commencement of our studies, we fall into a contracted, imperfect mode of reasoning.

After giving this warning against the abuse of the physical signs, I may proceed to point out the best method of avoiding or overcoming the difficulties which we meet with at the commencement of our studies. They depend, in a great degree, upon the difficulty of finding fixed starting-points, from which the study of the subject may begin.

If we could acquire distinct ideas of the sounds of the chest from description, the difficulty would, in a great degree, cease; but this requires much care and attention; and by a little effort on the part of a physician who is interested in the subject, we believe that most of the difficulties may be obviated. To aid him, it is therefore necessary to explain fully the best mode of learning the sounds; that is, of acquiring a sufficient number of sounds to serve as a point of departure and guide for subsequent study. This method supposes that the sounds are analyzed and separated into their elements, and requires, at first, more than an ordinary share of attention; but the whole time required for learning the art is much shortened, and the subject greatly simplified.

Most of these initial sounds may be discovered in the healthy body; that is, sounds sufficiently similar to those we meet with in disease, to enable us to recognize them when they are heard; and if these are thoroughly learned, the remaining sounds, which are the most easy, are quickly acquired. We will find it to our advantage, therefore, to follow very nearly the process which I shall point out, for the purpose of simplifying those sounds; for, although it is not indispensably necessary for us, it is highly useful, and really will shorten the time and attention required in their study.

In studying the physical signs, I follow, as nearly as possible, the most natural method, reserving to myself, however, the privilege of deviating from it as often as may be advisable.

The physical signs, properly speaking, may be classed under the heads of alteration in the conformation of the thorax, and of the resonance of the chest on percussion, and the sounds yielded

by respiration, or produced during the act of coughing or speaking. These constitute the signs which may be regarded as strictly physical. There are some other signs which, although less important, are to a certain extent classed among the physical signs; they belong more properly to the conformation of the thorax than to any other division: under this head I shall treat of them. These are—succussion, or giving to the patient a sudden shake, to ascertain the presence of air and liquid in the cavity of the pleura, which is rarely practiced, and is, in the majority of cases, both totally unnecessary and highly disagreeable to the patient; palpation, or examining the chest by placing the hands upon it and pressing them carefully along the lateral portions of it. Mensuration of the chest, by means of a spirometer, belongs to the same class of signs.

CONFORMATION OF THE THORAX.

The thorax, it is well known, resembles an irregular truncated cone. It is flattened both anteriorly and posteriorly, and presents numerous inequalities, depressed in one part and elevated in another. For the convenience of study, it is usual to examine it anteriorly, posteriorly, and laterally. Of these surfaces, the lateral, or the axillary, are the most regular; the posterior, the least so. The walls of the thorax do not represent precisely the space occupied by the lungs and heart; for the liver, spleen, and stomach encroach slightly upon the lower part of the cavity. This is particularly the case with the liver, which rises on the posterior part of the right side of the chest nearly half an inch higher than the corresponding boundary on the left side. On the whole, the lower boundary of the right side may be represented by a line drawn from the spinous process of the twelfth dorsal vertebra to the lower bone of the sternum; on the left side the boundary begins also at the twelfth dorsal vertebra, but passes at a distance of half, or at least one-third of an inch higher, until it reaches the præcordial region. The lower boundary of the chest, as thus defined, is not always the same, as the size of the liver is of course variable, and the dimensions of the thorax are necessarily influenced by this circumstance. This line is not followed with

perfect regularity, especially on the left side, where the heart passes a little beyond the limit of the adjoining part of the chest. At the upper boundary, the difference of the two sides is less; on the right it sometimes rises a little higher than upon the left, from the greater development of the muscles and bony parietes of the thorax on that side; but this difference is, in general, so slightly marked as scarcely to attract attention. The lungs extend a little beyond the clavicles, especially during the act of full inspiration, but to a distance not exceeding half an inch. At the posterior part of the chest, the upper boundary is formed by a line drawn from the upper dorsal vertebra, outward and downward toward the point of the shoulder.

When the conformation of the thorax is perfectly normal, it presents an irregular plane on each of its four sides; but the angles of these planes are sufficiently rounded to retain a general conoidal shape. Each side of it offers several elevations and depressions; at the anterior part these correspond with peculiarities of form of the viscera, and are really formed by the parietes of the chest; but the irregularities of form at the posterior surface are owing, in great part, to the muscles, to the spine, and to the scapulæ. The clavicles form a ridge, which is slightly arched; the space above them is therefore depressed, except the patient be extremely corpulent, dropsical, or else labor under certain diseases of the lung or pleura. Beneath the clavicle another depression, but one much shallower, exists. It extends to the lower part of the second rib. The space below this depression is slightly and regularly convex as far as the upper edge of the liver; at that level there is, in many persons, on the right side, a slightly depressed line, which corresponds with the interval between the liver and the lungs. On the left side, in young persons, there is often a prominence corresponding to the heart; this is slightly marked, and never decided, as it is in cases of real disease of this organ, or effusions within its investing membrane.

The lateral portions of the chest are regularly bulging from the apex to the base; and as the walls are here thinner than elsewhere, and nearly without muscles, the external form corresponds nearly to the lungs.

The posterior surface is rendered irregular by the scapulæ; but at the part uncovered by these bones its form is nearly as regular as that of the other portions, gradually widening toward the base of the chest. A slight depression or gutter exists on each side of the spine for the reception of the dorsal muscles.

The lower and posterior portions of the chest are often dilated from effusion into the pleura, and yield to the pressure of liquid from within with great readiness. The upper part is not changed in conformation, except the quantity of liquid be very large. The contraction of the chest is also extremely obvious at the lower portion, after the absorption of pleuritic effusions.

In children the form of the chest is much more rounded than in adults; and in women, although the exterior seems more irregular than in males, yet the proper bony parietes are much more regularly formed, and are more conoidal in shape.

The conformation of the chest, it is well known, is often characterized by individual peculiarities. Thus, some persons are called chicken-breasted, from the prominence of the sternum, and others present a well-marked depression at the lower portion of this bone, which is sometimes congenital, and at other times is caused by trades or occupations which oblige the followers of them to work in a constrained posture, leaning forward; this is particularly the case with shoemakers, who nearly all present this depression after working at their trade for a few years. Other individuals who are thin, and of a feeble constitution, offer a remarkable contraction of the parietes of the chest; but in all these cases, the contraction is more or less general, instead of being confined to a single part of the chest. When it depends upon disease it is generally much more local, and is caused, in nearly every instance, by pleuritic adhesions, which draw the walls of the chest toward the lungs. Enlargement of the chest beyond the natural average is nearly as frequent as contraction. When it coincides with a general development of the body, and evidently depends upon a stout and large frame, it is of course indicative of health rather than disease. The morbid dilatations, properly so called, are local, either limited to a part, or to the whole of one side of the chest; on this account they are

readily recognized. They depend either upon an anormal development of the internal organs, or upon dilatations caused by effusions of air or liquid into the serous cavities of the chest. The comparison of the two sides is requisite, in order to recognize dilatations or contractions of the chest; and the thorax must be examined throughout in nearly every position, so that its true and relative dimensions may be ascertained.

It is not necessary that the chest should be exposed in order to examine its conformation, although this is much more convenient than to inspect it when covered. When no objection exists to exposing the chest, the patient should be placed in a sitting posture, or he may remain standing; if that be impossible, he should lie upon his back, and quite straight, so that the light may fall upon his chest; a cross light may, of course, give rise to error. The patient should then remain at rest, with his arms lying quietly by his sides or slightly crossed, if the posterior part of his chest be examined: in this way the whole of the anterior or posterior surface may be taken in at a glance. An examination of this kind is, of course, not practicable in cases of women, or of patients who are sweating profusely; under such circumstances, we must content ourselves with the partial inspection, which is practicable when the body is more or less covered by clothing, and we may aid in this examination by passing the hands lightly over the thorax. For in most cases this is amply sufficient for the purpose, and is free from the disagreeable circumstances which attend the exposure of the person. The examination by the touch is especially convenient for the posterior and lateral parts of the chest, where the morbid dilatation is generally most considerable.

The examination by the touch is called palpation, but I do not think it at all necessary to multiply terms in the description of the methods of physical examination. Palpation, then, is nothing more than the examination of the chest by means of the touch; it aids the sight, and often may be substituted for it when the patient is too thickly covered. The hand forms, as it were, a kind of natural callipers, and will give very accurate results. If we examine the lateral and inferior portions of the chest, we may place the whole palmar surface of the hand

upon it; if the anterior and upper portions be examined, the fingers may be passed lightly over it. In this way we can detect any abrupt deviations from the natural conformation, but a general and moderate rise or depression can scarcely be detected, except by the sight. If we cannot resort to this means of investigation, we must content ourselves with the other physical signs.

Dilatation of the chest is necessarily produced by all diseases which give rise to enlargement of the pulmonary vesicles, or to distention of the pleuræ. Those which act upon the pleuræ are inflammation, the products of which are serum, lymph, and purulent matter; or dropsy, in which the secreted fluid consists merely of serum. The effusions arising from pleurisy are nearly always confined to one side of the chest, take place rapidly, and are much more local than those of hydrothorax, which extend over a large surface, and are not confined to a single lung. Hence, the pleuritic distention begins chiefly at the base of the lung, and extends upward, involving the whole of one side only in those cases in which the quantity is extremely great. Pericarditis gives rise to dilatation from the same cause as pleurisy, and the prominence follows very nearly the shape of the pericardium, and is therefore somewhat triangular, the small extremity pointing upward. The extreme dilatation which takes place in severe cases of pleurisy, in which the whole side of the chest is enlarged, elevates the shoulder, and gives the whole body an inclination toward the healthy side. This is often evident when the patient walks or sits in the erect posture. The effusions of liquid into the serous membranes give rise to the most decided, and, as it were, abrupt prominence of the chest; while the dilatation produced by enlarged vesicles is, in general, less decided, or at least more gradual. It gives rise to a more equable and moderate bulging of the chest than that from effusions of liquids into the serous cavities. Of course it is most marked near those parts of the lung where the vesicles are most frequently dilated—that is, along the anterior portion of the chest, on each side of the sternum; but if it involve a large portion of the lungs, the shoulders are sometimes elevated, and

the space above the clavicles becomes prominent, instead of offering a slight depression, as it does in the natural state.

Contraction of the thorax is a consequence of many diseases in which pleurisy has occurred, either as a primary or secondary lesion; but it is most marked in cases of primary pleurisy, especially where the quantity of effused liquid has been large. After the secondary pleurisy which follows or accompanies phthisis, contraction almost invariably takes place, and usually occurs near the summit of the lungs, so that the natural depressions, both above and below the clavicle, are exaggerated. Sometimes the depression reaches to the lower portions of the lung, as in ordinary pleurisy. The latter variety usually follows those cases of phthisical pleurisy which have commenced in the ordinary mode followed in common pleurisy, and in which the development of tubercles takes place rather late in the disease, after the inflammation has ceased or at least has diminished. The general rule holds good, that contraction is evidence of previous pleurisy,—the exceptions are nearly all of a doubtful nature. In a few rare cases the tissue of the lung contracts from the partial or complete cicatrization of a cavity, perhaps from inflammation, although the attendant pleurisy may not be sufficiently extensive, or the adhesions strong enough to account for the depression. In these cases we are bound to admit that the pressure of the atmosphere has filled up the vacuum which would otherwise have been left. In the depression which follows pleurisy, it is true that the process is somewhat similar, as I shall show when speaking of this disease, but it is less strictly physical, and is in part more dependent upon the contractile power of the adhesions. The absorption of the effused liquid in pericarditis does not give rise to a decided depression; it sometimes exists, but only in a slight degree.

These are the general indications derived from an examination of the form of the thorax, and they are distinct chiefly from the results which are derivable from the sight and touch. In a few cases the chest may be measured on the two sides, in order to estimate the difference in the semi-circumference more exactly, by passing a tape around the thorax, from the extremity of the spinous process of the vertebra, then marking the point corre-

sponding to the middle of the sternum, and afterwards comparing together the two parts extending from the sternum to the spine.

The seventh or eighth dorsal vertebra is the most convenient for this purpose. The measurement which is thus obtained is, of course, correct; but it applies only to those cases in which the difference is very evident, unless the dilatation occurs at the left side. In the latter case the increased dimensions are readily perceived; for the right side is naturally larger than the left, and the difference is more or less, according to the habits which the individual may have of exercising the right arm more than the left: a difference in favor of this side would therefore be comparatively of little moment, and mensuration is therefore of little value as a diagnostic sign.

Another mode of examining the conformation of the chest is by means of callipers or steel instruments, the dilatation of which shows us any alteration of form, by repeating the examination at different parts of the chest. This mode of examination I regard as profoundly useless. In the first place, it is, after all, but an imperfect mode of measurement, by far the best being those by the eye, or by the application of a tape. In the next place, it is annoying, and often requires an exposure of the patient.

The true mode of ascertaining the conformation of the chest is, in the first place, to look at the patient carefully when he is in a proper position, and, of course, when he is but lightly clothed; in the next place, the chest may be measured by passing a tape around it. The investigation of the mode in which the patient dilates and contracts his chest during the act of respiration belongs also to this part of the subject; that is, we should carefully inspect the acts of inspiration and expiration, when either contraction or dilatation of the chest becomes more prominent than it would otherwise be.

There is another mode of exploration which is termed succussion; it belongs to this part of the subject as properly as to any other. I use the term merely to explain the method of performing it, not to advise the reader to resort to it. The method

itself is sufficiently simple, and consists merely in placing the hands on the shoulders of the patient, and giving him a sudden jerking motion. If both air and liquid are contained in the cavity of the pleura, a gurgling, almost a splashing sound, is produced. There are other and better methods of investigation, which are sufficient to make the lesions which cause these sounds perfectly evident, so that we need not, in any case, resort to succussion.

CHAPTER III.

PERCUSSION—RATIONALE—MODE OF PERFORMING—PLEXIMETER—DIVISION OF CHEST INTO REGIONS—VALUE OF PERCUSSION.

We now come to a highly important part of the subject—this is, percussion, or the method of estimating the density of the viscera contained within the thorax, by tapping lightly upon its surface. The rationale of this is very simple: the lungs occupy the greater part of the thoracic cavity, and are filled with air. If percussion be made upon them when removed from the body, they yield a very clear sound, especially if a solid yet elastic substance be laid upon them, so that it may receive the impulsion of the striking body, and prevent it from sinking into the soft pulmonary tissue: this elastic body, or sounding-board, exists naturally in the thorax, and is formed by ribs and cartilages; and a light tap upon their surface, that is, on the exterior of the chest, gives a clear, full, hollow sound.

When the patient is thin, and his skin is very sensitive, he will not bear a smart tap without inconvenience; and, on the other hand, if he be very corpulent, or if the subcutaneous cellular tissue be infiltrated with serum, the sound will be quite dull, and will not truly represent the condition of the internal organs. In order to prevent this chance of error to the observer, and of inconvenience to the patient, we place an additional elastic body between the chest and the end of our finger. This interposed body is called a pleximeter, and was invented by Dr. Piorry. Its only utility is to increase the body of sound, by giving more resonance to the elastic parietes of the thorax, and to prevent the direct impression of the fingers upon the chest of the patient. Though the ribs are an excellent natural pleximeter, they are too sensitive at times, and at others are rendered useless for physical

exploration by the softer subcutaneous deposits. By applying an artificial pleximeter we not only increase the resonance of the natural sounding-board, if we may so call it, but we bring it more fully into play by compressing, and, as it were, thrusting out of the way the tissues which impede its vibrations, and then we gain the important advantage for ourselves and our patients of preventing pain which might perhaps increase the disease. The only method of performing percussion which is now practiced is that by means of the pleximeter. It has so many advantages over immediate percussion, or the striking with the ends of the fingers directly upon the chest, that it is much better fitted for every purpose.

The pleximeters used are various—we mean those that may be used; for, practically, they are reduced nearly to the most natural pleximeter—that is, the forefinger of the left hand. But if we choose, we may make use of a piece of gum-elastic, of ivory, or of metal. We take this in the fingers of the left hand, and hold it firmly upon the chest, afterwards percussing in the usual way with the right hand. If it be not applied firmly against the chest, a clacking sound is immediately produced by the air which is interposed between the instrument and the skin: this clack cannot be entirely obviated, for the tap upon the instrument will of course give rise to sound. If the material be very dense, the sound will be sharp and decided, and interfere a little with the pulmonary sound, that is, the resonance developed by the tissue of the lungs; for this reason there are some advantages attending the use of the gum-elastic pleximeter, rather than an ivory or metallic one, which is harder, and of course gives rise to more of the tapping sound. The elastic instrument was, I believe, first proposed by Dr. J. B. S. Jackson, of Boston, and is the most convenient. We can readily enough make one for ourselves, by taking a common piece of gum-elastic of the flat kind, about a quarter or a third of an inch thick, and about two inches square, that is, of a size convenient for holding in the fingers. The density of gum-elastic is more nearly similar to that of the chest than a harder material, which is an additional reason for its employment, as it thus gives a clear, uncomplicated sound.

The gum-elastic pleximeter is easily made, but we are provided

with one which is much more simple, and which I always resort to—it is the forefinger of the left hand. In thin persons, the finger is even more bony and more elastic than the ribs; but in those who are fatter, or whose hand is remarkably stout and covered with a thick skin, the finger loses its elasticity, and is not so well fitted for the office of pleximeter. Still, under ordinary circumstances, it is the best one which we can employ, and is superior to any of the ordinary artificial instruments, from its ready adaptation to different parts and irregularities in the chest. The finger may in this way be placed behind the clavicle or below it, and be brought very near the lung, which could not be done if the pleximeter were a broad and flat plate: any single limited spot may be examined in the same way with great ease. This natural pleximeter may be used in two ways: we may apply the dorsal or palmar surface upon the chest, and, of course, must tap upon the reversed side. If we apply the palmar surface upon the chest, the dorsal side upon which the percussion is made is firm, and gives a sharp clear sound; it is much better, therefore, for the accurate appreciation of slight deviations from the natural standard. The palmar surface is occasionally more convenient for percussion, especially when it becomes necessary to apply the finger to the depression behind the clavicle—it is better for this purpose, that the finger should be curved to fit this depression; hence percussion must be made upon the palmar surface. Much of this nicety in the mode of applying the finger which serves as a pleximeter will be found to be unnecessary, and may be dispensed with after a little practice; the shape of the hand and fingers of the observer will, however, have some influence on the position which will be found in practice most convenient.

The most difficult part of percussion is not, however, the application of the hand which serves as a pleximeter; this is very soon acquired. Much difficulty, however, is often met with as to the method of tapping or striking with the right hand upon the pleximeter finger. We may use for this purpose either one finger or several, but we always find that for children, and for persons who are very thin, and whose chests are therefore quite sensitive, a single finger will be most convenient. Whether we use one or more fingers, the essential part of the process is to hold the hand

as firmly as possible, and to give the greatest elasticity to the wrist. The motion should therefore be performed at the wrist, and not at the shoulder or elbow; if we strike with the whole arm, however gently it may be, we are apt to give the patient pain, and we are sure to deaden the sound. The sound depends mainly upon the elasticity of the wrist, and if the fingers be suffered to remain in contact with the pleximeter or the thorax a moment longer than is necessary for the percussion, the sound will be proportionately obscured.

The slowness of the motion with which the tap is given is a frequent error with those who are slightly acquainted with physical exploration. They are apt to pause as soon as the finger touches the surface, and allow it to remain in contact with the part; this is altogether wrong. It is at first difficult to acquire the perfect freedom of motion which is essential to elastic, clear percussion; still, it is perfectly practicable, with a little perseverence and experience.

There are some persons who never acquire much readiness with percussion, however long they may attend to the subject; the difficulty is in the form of their hand, which is too stiff, or the fingers too thick to allow them to be readily bent and quickly struck upon the chest. They should therefore content themselves mainly with auscultation, trusting but very little to the signs of percussion.

If we use a single finger for purposes of percussion, there is little difficulty in placing it in the proper position. Either the fore or the middle finger of the right hand may be selected as the percussor; we then bring it, as nearly as possible, into the form of a light mallet or hammer, and make the second and third phalanges serve as the head of the hammer; of course, they must be flexed at right angles with the first phalanx, and must be retained firmly in that position, otherwise the form of the hammer is lost. The extremity of the finger should be nearly at right angles with the hand, otherwise the tap is not made with the extremity of the fingers, but the pulp, which is a matter of essential consequence, as the pulp of the fingers is soft, and non-elastic, and deadens the sound.

If the thorax be covered with fat, or the parietes be infiltrated,

it is necessary to percuss more strongly than is possible with a single finger; in that case, we bring the three middle fingers of the hand together, and allow them to rebound, after striking upon the pleximeter: they thus give a more forcible impulsion, and a sound nearly as clear as if a single finger was used. Indeed, we generally find this method the most convenient for the examination of the chest, although, as I have already stated, a single finger is the best percussor in cases of children whose chests are thin and very elastic, or those in whom the thorax is nearly in the condition of that of children, from great emaciation. Although when we use several fingers, our tap is of course stronger than if a single one be employed, we shall find in either case that it is not the force, but the sharpness and quickness of the impulsion, which produces the sound. A hard blow causes so much clacking sound against the finger that it proves a source of error, and renders the full resonance of the chest more difficult to draw out.

Plain and easy as these directions are, probably no one will at first practice them correctly; for we find that the elasticity of wrist, and light, clear tap, are learned but slowly, and after many efforts. There is, however, an easy method of improving our knowledge of percussion: we must repeat the operation frequently upon ourselves, at night, when we have removed our outer clothing, and all is quiet around us; a slight difference in sound then becomes perceptible, and the causes which render it dull are evident, and we thus learn to avoid those errors which are the more embarrassing from their apparent trifling insignificance. Notwithstanding all the care we may take, it is not easy to make equal progress in this matter; to acquire a perfect facility, a light and rather thin hand and a correct ear are requisite; if the physician has not these advantages, he of course experiences more difficulty,—but with increased practice and more attention, it may be overcome.

An instrument has been contrived by Dr. Bigelow, of Boston, for percussion. It is a piece of whalebone or elastic wood, covered at the end with a ball of velvet or buckskin; the ball is nearly an inch in diameter: it is a very good instrument, if any accident should deprive us of the full use of our fingers. The objections to it are, of course, the trouble and complexity of its

use; hence Dr. Bigelow himself advises it merely in hospital practice, where there is a large number of patients to examine, and our fingers sometimes suffer from constant tapping. In using this instrument, we tap with the ball upon the pleximeter, which should be made of gum-elastic.

While I was at Paris, some years since, an ingenious friend of mine imagined an instrument for measuring the sound of percussion. It was to consist of a percussor somewhat similar to that of Dr. Bigelow, but inclosed in a large stethoscope. The percussor was to be set in motion by a spring and wheel, as in watches, and the ear to be applied to the stethoscope in the usual way during the action of the instrument. The idea was ingenious, but the practical application of it almost impossible. Any contrivance to assist the senses in diagnosis must be extremely simple, or it will be practically useless; and, as a general rule, we do much better to trust to our hands alone for the percussion of the chest.

Percussion is applicable to the study of abdominal as well as thoracic diseases; indeed, it is largely applicable to the exploration of many diseases of the viscera of both cavities. The abdomen contains solid viscera, such as the spleen and liver, and tubes filled with gas or liquid. The gaseous contents are much more abundant than the liquid; hence the sound of percussion is clear over the greater part of the abdomen, from the gas retained in the alimentary canal. If the quantity of gas be increased, there is necessarily an increased resonance on percussion, and the converse is, of course, true; this fact enables us to estimate the effusion of liquid in the peritoneum, the enlargement of the solid viscera, and the distention of the cavity of the intestine with a large quantity of gas, which causes a tympanitic resonance. The same manual method of percussion is applicable here as in the exploration of the thorax; but, in general, it is found that a very light tap, with a single finger, is the best, especially in those cases in which the gas is contained in the larger intestines, and therefore approaches very near to the surface.

Percussion of the abdomen is always practiced when the patient is lying upon his back, and the surface of the abdomen is there-

fore placed in the situation most convenient for examination; but in the examination of the thorax the position may be varied; that is, we vary it in all those cases in which the patient is well enough to change his posture at pleasure: if he be too feeble for this, we must, examine him in any way that happens to be practicable. In ordinary percussion, our object is to place the patient in such a position as to render the parietes of the chest as tense, and consequently as elastic, as possible; the muscles must therefore be put upon the stretch, and the skin drawn tightly backward. In percussing the anterior part of the chest, the patient should sit upon a chair; or, what is still better, he may stand erect, and throw the shoulders slightly backward, so as to render the pectoral muscles tense. For the posterior part of the chest the position should be reversed; the patient must lean forward, and cross his arms strongly, to draw the scapulæ from the spine, and throw out the arch of the back. To examine the axillary region, the arms should be raised above the head.

The chest may be percussed at first in a cursory way on each side, to gain a general idea of the condition of the viscera, and afterwards we may proceed to the details, and compare the sonorousness of different parts of the lungs and of the heart. The lungs are not equally sonorous throughout their whole extent; for as the clearness of the sound depends upon the large quantity of air contained in the vesicles, and the small quantity of solid matter, a difference in the relative proportions of these parts will give rise to various degrees of resonance. Thus, the sound is most clear wherever the vesicles are most numerous, and the larger bronchial tubes, whose walls are thick and firm, are least developed; for the thin parietes of the vesicles present no obstruction to the vibration of the air contained within them, but the hard walls of the bronchial tubes offer a very decided obstacle. Hence, if other things be equal, the sound may be stated to be most clear at the lower part of the chest and along the anterior margin of the lungs, while it is comparatively dull at the summit and root; in the rest of the lungs the sound is intermediate, neither dull nor clear. Where the lungs are so situated as to overlap the more solid portions of viscera contained in the chest, the sound is but moderately clear, becoming more dull as the thick-

ness of the solid organ is greater than that of the lungs. This is the case both with the liver and heart, and is a fact which is analogous to the phenomena observed in a diseased state of the lungs, where a lesion which renders the deeply-seated parts of the pulmonary tissue more solid, makes the percussion dull over the corresponding parts of the lung. The dullness of sound is observed, notwithstanding the superficial portions of the chest in which the lungs are placed may be perfectly pervious to the air.

The relative quantity of bronchial and vesicular tissue gives rise to the modifications in the clearness of the sound in percussion to which I have alluded, and the resonance of the vesicular structure is quite different from that which would be caused by the same quantity of air contained in a single bag, or large vesicle. If the air contained in a large number of scattered vesicles were collected together, and percussion were made upon the sac which contains it, the sound would be drum-like, or tympanitic. This character is actually observed in certain morbid conditions of the chest, but it is never similar to the healthy sound, which is more deep and hollow, but at the same time less gaseous. The difference between the two varieties of the clear sound will be appreciated at once if we examine the chest, and then percuss downward until we come to the hollow viscera of the abdomen, which, when they are distended with air, yield the tympanitic resonance very different from the hollow sound which is caused by percussion on the lungs, and which is called vesicular.

Considerable difference in the resonance on percussion is produced by the position of the patient. Thus if he lies on a soft bed, percussion is of course rendered dull, from the absence of all resonance in the material on which he rests. If he lies upon a sofa, or a hard mattress, the natural resonance is not so much interfered with. Fortunately, however, it is in cases of slight or commencing disease that we require the most careful percussion; and then the patient is able to change his position, and to place himself almost precisely as we may choose.

It should always be remembered that the best and most uncomplicated sounds are obtained when the patient is standing erect. This is due to two causes: in the first place, he can put himself in

such a position as to allow no foreign body to interfere at all with the resonance of the lungs; in the second, it gives much greater freedom of motion to the physician, who can modify both the force with which he taps, and the position of his pleximeter finger, as he pleases.

Besides this, there is another reason for directing the patient to hold himself erect; it is, that when he places himself in such a position he loses to a great degree the fear which is always produced by submitting to an examination. When we percuss a patient, it must be recollected that the sound may be made intense enough to furnish satisfactory evidence of its clearness or dullness without the blow being sharp enough to occasion any pain. Hence the tap should be short, and, as it were, instantaneous. I generally repeat it two or three times, but not more.

In the examination of the heart by means of percussion, it is always preferable to have the patient in the erect posture; for greater care must be observed than in the percussion of the lungs, as we are obliged to lay more stress upon the comparative dullness which exists toward the outer portion of the heart.

In cases in which we cannot change the position of the patient at pleasure—that is, in cases of severe disease in which he is much exhausted—with a little precaution we can still use percussion to advantage. For example, in acute pneumonia, if the patient be excessively enfeebled, we can still always have him supported for a moment in bed by an assistant, while we quickly tap over the lower lobes of the lungs, which is the part usually consolidated in pneumonia. Even in children there is no difficulty in percussing pneumonic patients; but here we must remember that the sound is more equal on the two sides of the chest, because the disease is rarely confined to a single lung; besides which, the dullness is usually less marked in them than in adults.

After we have gained a general idea of the resonance of the chest, we should proceed to a more thorough examination of the various portions of it one by one. For this purpose, it is convenient to divide the chest into regions or parts. These may be the anatomical divisions corresponding to the exterior of the chest, as the clavicular, scapular regions, etc.; or we may use

terms expressive merely of the fractional parts into which the surface is divided, such as thirds, fourths, etc. For most purposes, the latter method has seemed to me to be the most convenient. When we wish to be more exact, we may subdivide these regions, or we may, in addition, designate them by a reference to their anatomical relations; but if we divide the anterior and posterior surfaces into three parts, and the axillary into two, it will be sufficiently minute for most purposes.

The anterior surface may be divided, therefore, first, into an upper third, extending from the summit of the lung to the upper margin of the third rib, and including the anatomical subdivisions of post-clavicular, or the space above the clavicle; clavicular, that corresponding directly to this bone; and sub-clavicular, or the region found immediately beneath it. This portion, in general terms, may be said to correspond with the summit of the lung, and is of great interest to the physician; for it is the ordinary seat of tuberculous diseases, which of course render the sound dull; and occasionally of pneumonia, which produces the same effect in a more marked degree; and, thirdly, of emphysema, which renders the sound preternaturally clear.

The middle third extends from the lower margin of the upper division to the space between the fourth and fifth ribs; it is less interesting for practical study, for its diseases are, for the most part, rather such as begin in the upper or in the lower third, and extend themselves to the middle, than those which commence in it. Emphysema, however, is often more developed about the middle of the lung than in any other part of this surface.

The lower third extends from the boundary of the second to the lower margin of the chest; it is the usual seat of pleuritic effusions and of hydrothorax; in both of these diseases the liquid extends itself gradually from the posterior parts of the chest, toward its anterior margin, rendering the lower portion dull.

On the left side of the thorax the extent of the sonorous resonance is much less than upon the right side, owing to the position of the heart. This should always be borne in mind in the percussion of this part.

In the healthy condition the sounds of percussion are not equally sonorous in all parts of the anterior surface of the chest;

in children the lower third is decidedly the most sonorous; in adults the middle is generally the clearest. In women we shall find it difficult to compare these various portions together, for the mammæ interfere so much with percussion that it is often extremely difficult to examine the middle third in a satisfactory way. The heart is another cause of dullness of sound at the internal part of the lower third on the left side. The præcordial dullness extends from the space between the fourth and fifth ribs at the sternum to the nipple, generally passing a little within this part. On the right the dullness is bounded by a line which follows the middle of the sternum; the lower part of the heart rests upon the diaphragm, and the percussion is therefore dull to the base of the thorax.

The axillary or middle surfaces are divided most conveniently into two portions, by a line drawn transversely through the middle of the axillæ. The sound in these parts differs in a very slight degree, and is throughout extremely clear, from the almost complete absence of the more solid parts of the lungs, and the remarkable freedom of this portion of the chest from muscles which necessarily deaden the sound to a greater or less degree.

If the posterior part of the chest be divided into thirds, these portions are still more unequal in their resonance than they are at their anterior part. The upper third extends from the top of the lungs to a line passing along the spine of the scapula, prolonged to the vertebræ. This, like the summit of the lungs at its anterior part, is the common seat of tubercles, which are more frequently developed here than at any other portion. Percussion is, however, so difficult at this part of the lungs, from the thickness of the muscles, that its results are not of great value to beginners. Under all circumstances, the sound is but moderately clear, becoming duller toward the external margin, for there the percussion is necessarily harsh upon the super-spinal fossa of the scapula and the thick muscles covering it.

The middle third extends from the lower margin of the upper, to a line drawn at an obtuse angle to the spine from the lower angle of the scapula, and parallel to the lower boundary of the upper division. The natural sound is here much more clear than in the upper third, especially near the spine, where the scapula

does not interfere with it. Upon the scapula the percussion is necessarily dull, in consequence of the mass of muscle and cellular tissue surrounding it.

The lower third corresponds to the largest mass of pulmonary tissue, and, from the conformation of the ribs, gives a remarkably clear sound in children, in whom the thorax is elastic. In adults, the greater firmness of the ribs and muscles, and the greater induration of the ligamentous and cartilaginous tissue, renders this sound less hollow; still it is always comparatively clear. This portion of the chest, with the middle third, is the usual seat of pneumonia; it is also the commencing point of pleuritic effusions; hence in these diseases it is often dull when the rest of the chest is comparatively clear.

The clearness of sound at the lower margin of the chest is much modified by the position of the liver; this organ, as is well known, rising up to a certain degree against the lung, and below the inferior ribs. The dullness of sound at the lower margin of the right lung extends over a breadth of half an inch, and is caused by the convex form of the liver, which is partly covered by the lung. The flatness of sound exists below this space; its level is about half an inch higher than on the left side. The cause of this dullness is undoubtedly dependent upon the situation of the liver at this spot.

After we have examined the chest in a cursory manner, the regions must be examined comparatively; that is, each part should be compared with the corresponding one upon the opposite side at the same points. For purposes of convenience I generally begin at the summit of the lung, at the anterior part, and then pass downward toward the diaphragm, percussing both over the ribs and in the intercostal spaces, and always placing the finger of the left hand parallel to the ribs; this gives us the sound corresponding accurately with the portion of lung which is immediately beneath the finger, or very little more than the sound corresponding with that space. If we percuss across several ribs, the sound is more difficult to appreciate, as it is produced by a much larger portion of the lung, and is therefore of little value, except for the facility which it gives us of gaining a general idea of the condition of the lungs. Besides, when we percuss over

several ribs, we obtain a sound coming from a greater space in the chest than that immediately over which our percussion is performed; for we must remember that every rib is, to a certain degree, a pleximeter, which not only increases the quantity of sound, but gives us a reverberation from a greater space. Hence we may be led into error, unless we pay attention to this circumstance. If we are at all doubtful about the sound, I would advise that the two sides should always be compared together in very quick succession, while the impression of the sound is still fresh in the senses, and the percussion should be repeated until we are satisfied whether there is or is not a real difference.

In a certain proportion of diseases of the lungs, the signs of percussion, united with the general symptoms, are sufficient for the diagnosis; and, if combined with the other physical signs, they are sometimes perfectly characteristic of the disease, without the aid of the rational symptoms. It must be remembered, however, that percussion indicates merely the relative density of the lung, and is not sufficient for the diagnosis of most of its diseases without the aid of other means of investigation. But the signs of percussion, although comparatively few in number, are often of more value than any others, for their evidence is positive as far as it is applicable, and indicates with perfect accuracy the density of the tissue beneath the spot upon which the percussion is made; but as the causes which influence the density are numerous, they are not explicable without the comparison of other symptoms. Percussion is, therefore, of all the signs of pulmonary disease, the most strictly physical, and of course the most mathematically correct. Percussion is not confined to the diseases of the lungs; for as these organs surround the heart, the sound is clear as far as their tissue extends; hence the size of the heart is measured by percussion of the lungs, rather than of the organ itself. It is, as we shall afterwards see, one of the most certain methods of learning the size of the heart.

The practical mode of acquiring percussion is of more interest to us than the mere detail of the signs derived from it. Like all the means of pectoral investigation, percussion may be learned in two ways—that is, either on the healthy or diseased subject. Those physicians who observe patients on a large scale, and have

sufficient time to examine at their own leisure the cases which they meet with in practice, will learn percussion chiefly from patients, and, as it were, in connection with other signs. But this is not always the more convenient method; it is not at all fitted for those whose sense of hearing is not acute, or who may not possess the necessary facilities for studying disease among a large collection of patients.

If the ear is to be educated as well as the hand, we may cause no little uneasiness to our patients in attempts to gain, little by little, a familiarity with the sounds. The pupil is sure to percuss much too smartly for their comfort at least, and may possibly aggravate the symptoms of their diseases. We should, therefore, always learn on our own persons; or, what is still better, several who are engaged in this study may unite together, and form little clubs for mutual percussion, so as to get on much more rapidly. For the healthy chest presents every shade of percussion, from complete flatness to the most perfect sonorousness, and we may thus accustom ourselves to every variety of sound. At first should be examined the parts of the chest where the sounds are most distinct; and for this purpose it is best to select a young person, and, if possible, one who is rather thin; then by percussing first on the middle of the side of the chest near the sternum, and afterwards on the region of the liver, we may gain a correct idea of the difference between perfect flatness and the full, clear, pulmonary sound. This should be repeated frequently, until a good idea of the difference of these sounds is impressed upon the memory, and, above all, upon the senses. The same points of extreme flatness and sonorousness will explain the difference between the tapping with a single finger, and the deeper but less sharp sound produced by decided percussion with several fingers. These comparative points should be examined on several individuals of different ages, and different degrees of flatness or thinness, until a correct idea of the average sounds is acquired.

After the extreme degrees of sound have been repeatedly heard, the intermediate characters may be learned by percussion of the præcordial region, where the sound is dull, but in the healthy subject not completely flat. There is also a little dullness of sound at the summit of the lungs; that is, on the right side, in

most individuals, it is a little less clear than upon the left. The repeated examination of these parts of the chest will not only give us a correct idea of the sounds themselves, but will train our ear and hand to the manual performance of percussion.

I have pointed out the great accuracy of the signs of percussion, and their uniform dependence upon the same physical condition of the lungs. It matters but little whether the disease is seated on the surface of the lung or in the internal parts of it; the quantity of air, as recognized by percussion, is necessarily diminished by every hardening of the tissue which is extensive enough to compress one or more lobules. Whenever the obstruction is sufficient to form an alteration in the sound perceptible to our senses, it may be readily recognized. The induration is obvious when three or four lobules become impervious to the air, but it cannot be known with certainty, if limited to a less extent. The deeper seated lesions are rather more obscure than those nearer the surface, as the air-vesicles which intervene between the ear and the indurated portion must give rise to a clear sound, on percussion, but it is less full and hollow than it is when the lung is completely free; for the plain reason that the mass of sonorous, that is, of aerated tissue, beneath the finger, when we percuss, is less considerable.

A compression of the lung acts much in the same way as an induration of its parenchyma; hence effusions into the pleuræ, or even into the pericardium, compress the pulmonary tissue, and render it less elastic—that is, they diminish the size, and expel the contents of the air-cells. The compression which is at first produced does not give rise to as great a degree of dullness as the induration of the pulmonary tissue, for the whole tissue remains pervious, and is merely a little less distended with air than usual; but in advanced cases of effusions into the plura, the flatness may be more complete than under any other circumstances, for the compression, although slow, may be carried to such a point as to alter the structure of the pulmonary tissue completely, and flatten it against the spine. In the pericardial effusions the compression is never so great as to destroy the resonance except immediately around the liquid.

Life has but little to do with the clearness or dullness on per-

cussion; for in the lung removed from the dead body we find precisely the same condition of things under the same circumstances, and we may readily verify the fact for ourselves, if we attempt to make the examination of the body of an individual dead of a disease which alters the structure of the lung,—or we may resort to the same experiment, by producing a change in the density of the lung by artificial means, such as injections of wax into the bronchial tubes, or of liquids or of air into the serous cavities, when the percussion is flat; if, on the other hand, we distend the vesicles by inflating them with air, the percussion immediately becomes extremely resonant.

We find that in healthy individuals there is often a considerable difference in the sounds of percussion. I have already alluded to some of the causes of this difference, which may be perfectly external to the chest, and consist in accumulations of fat or serum beneath the skin; or, on the other hand, they may depend upon a want of resonance in the thoracic parietes, and arise from the partial ossification of the cartilages. There is a third class of patients who offer less than the average degree of resonance of the chest; in these individuals the lungs contain less air than usual, and are apparently more firm and more similar to cellular tissue. The chest, on the other hand, may be more resonant than the average, from either a real dilatation of the vesicles of the lungs, or from the patient being greatly emaciated without much disease of the lungs themselves. There is but one way of overcoming these difficulties, and that is, to examine the chest in many patients until we acquire a knowledge of the average clearness or dullness of sound, and of the circumstances which modify it without the development of positive disease of the lungs. These accidental circumstances are altogether dependent upon ordinary acoustic principles: elasticity and thinness of the parietes of the chest favoring the clearness of sound, and thickness and rigidity of them producing a contrary effect.

CHAPTER IV.

AUSCULTATION—MODIFICATIONS OF RESPIRATION AND VOICE—BRONCHIAL RESPIRATION—CAVERNOUS—AMPHORIC—RUDE. SIGNS OF THE VOICE, PECTORILOQUY, BRONCHOPHONY.

WE now come to the most important means of physical exploration—that is, auscultation, or the act of hearing and interpreting the sounds produced in the chest either during the act of respiration or of coughing or speaking, or caused by the action of the heart. Percussion teaches us merely the density of the tissue of the lungs; but auscultation goes much further, and not only indicates the physical density of the tissue, but the functional play of the organs, and the obstructions which impede the passage of the air in the lungs, or of the blood in the heart. Hence the signs of auscultation are much more decided than those of percussion; they are developed by the patient himself, and of necessity cease with the termination of life. They are more complicated in their nature than the signs of percussion, and are less easily recognized, because they may be modified by a greater number of circumstances: but when these are taken into the account, the deductions from auscultation are quite as conclusive as those from percussion, and at the same time are much more precise.

The mode of practicing auscultation is extremely simple; we may apply our ear directly to the chest, or we may interpose between it and the thorax of the patient a solid or flexible tube; hence auscultation is said to be either immediate or mediate. It is immediate when the ear is directly applied, but mediate when a tube is interposed between the ear and the chest. As the sounds are produced by the patient, and not by the hand at first, as in percussion, it is thus a very easy task; but it will be found of more difficulty when we arrive at the sounds themselves, and to their interpretation. Some, in themselves, are not easily

learned; but others are difficult, only because they differ one from another by slight shades, and may therefore readily be confounded together.

For most purposes, immediate auscultation, or the direct application of the ear to the chest, is preferable to the use of a conducting tube. Those who are perfectly habituated to the exploration of the chest, prefer this method in the great majority of cases, on account of its greater rapidity and facility of application, for there is no previous preparation necessary, nor is there any difficulty in passing the ear rapidly over the chest. But in those portions of the thorax where the space for the application of the ear is extremely limited, such as the clavicular regions and the axillæ, or above the mammæ in females, the stethoscope, as the conducting tube is called, will be found preferable. Besides these reasons of mere expediency, the sounds themselves are sometimes better characterized, although not so well limited in mediate auscultation. This is the case with the heart, and even with the lungs; for, as the instrument covers but a small space, and is almost perfectly isolated from the rest of the chest, the sound which is produced near the limited portion covered by its extremity is alone conducted to the ear—and that coming from the adjoining parts of the thorax is not heard, or at least is so feebly heard that it does not materially interfere with the result.

When we apply the ear, we place the large surface of the head in contact with the chest, and as the bones of the chest and head are tolerably good conductors of sound, we hear the sounds of a larger portion of the lung than is desirable, and acquire less precise notions. But when we wish to examine rapidly a large portion of the chest, much time is gained from this very circumstance, as the sounds from a large space, such as a whole lobe of the lung, or nearly so, may be heard upon a single application of the ear; and if we are really familiar with the sounds, they can be analyzed and distinguished one from another, though heard at the same time, just as several instruments can be recognized in the same piece of music played by a complete orchestra. For ordinary purposes, therefore, immediate auscultation is much to be preferred.

If an instrument for conducting the sound from the chest to

the ear be used, we shall be obliged to take more precautions. This instrument is called a stethoscope, and is nothing more nor less than a tube of light wood, such as cedar; the extremity which is to be applied to the chest is hollowed into the form of a cone, the apex of which terminates in the tube, so that it serves as an ear-trumpet to conduct the sounds.

The substance of the tube, although a comparatively good conductor of sound, is of much less service than the column of air; for an ordinary flexible ear-trumpet, in which the sound is conducted exclusively by the column of air, is an excellent stethoscope. The diameter of the base of the cone should be from an inch to an inch and a quarter; if it be much larger, the sounds are confused, and the instrument loses its greatest advantage, that of concentrating the sound within a limited space; if too small, the sound is not loud enough. The essential point in the construction of a stethoscope is, that its cone should be deep and well hollowed out, at least an inch and a half or two inches deep, as is the case with all the good instruments now made. The cone should be perfectly simple, and not curved, as was formerly the practice with many instrument-makers. The length of the tube may vary from four or five inches to a foot; six or seven inches will be found to be of a very suitable length for most purposes. The diameter should not exceed a quarter of an inch; care must be taken to have it smooth and well polished throughout its whole length. The ear-piece should be slightly convex or flat, or we may have a nipple-shaped projection, to insert into the ear; it should be of the same material as the rest of the tube, and not of ivory, as is often the case. For myself I prefer a tube with a perfectly smooth extremity; but there will be some difference of opinion as regards this matter, depending in part upon habit, and in part on the form of the ear. The ear should not be so near the chest as to expose us to the inconvenience of immediate auscultation, nor so far removed from it as greatly to diminish the intensity of the sound, for the sound becomes more gradually less and less loud in proportion as the ear is farther removed from the part of the lung in which it is produced.

A flexible tube—that is, an ordinary ear-trumpet, about eighteen inches long, with the open end brought nearly to the form of the

extremity of the stethoscope, is, perhaps, the best instrument for the examination of the sounds of the heart, as it does not conduct the impulse to the ear; hence the sounds alone are heard without the impulsion, which renders their analysis more difficult. Dr. Pennock, formerly of Philadelphia, who has devoted great attention to the diseases of the heart and their signs, was the first to introduce the flexible tube for this purpose, instead of the ordinary stethoscope.

A variety of fanciful stethoscopes, formed in different ways, have been introduced by gentlemen ambitious of the title of careful observers. Thus they are made of many different materials: the ear-piece of one is pointed, that of another flat; the thoracic extremity is also modified.

Dr. Cammann, of New York, has invented an instrument with an ear-piece adapted to each ear. In this, however, he has been singularly forgetful of the fact that for careful hearing or careful sight, one ear or one eye alone is used. Hence I regard the application of an instrument of this kind very much in the same light as I should that of a double telescope or a double microscope.

Indeed, in my habitual auscultation, I have almost totally given up the use of stethoscopes, the unassisted ear being vastly preferable, since it gives us the true sounds of the chest in a much more satisfactory way than we could obtain them by means of any additional instrument. For it must be remembered that all stethoscopes diminish to a certain degree the clearness of the sounds; therefore I do not look upon them as positively necessary in any case. They are, however, sometimes convenient when it is disagreeable to apply the ear to the chest of a dirty or even feeble patient. They are also sometimes proper in the examination of the heart in women, especially if they are corpulent.

I shall not enter further into the description of the mere instrument, which we may procure from any turner, but I must give some cautions respecting the mode of application of the stethoscope. If we apply it directly upon the chest, we must take great care that the end be placed flat upon the skin, without inclining to one or the other side, as the sounds are both modified and lessened by the admission of air between the thorax and the tube.

Indeed, it is better not to place the instrument immediately upon the skin, but upon an under-garment of muslin or flannel; this fills up the insterstices between the tube and the surface, and prevents pain, from too strong a pressure. This covering must be thin and not stiff, hence starched linen and silk are both improper, as they give rise to a rustling sound, and obscure the respiratory murmur.

When patients are much emaciated we can hear very distinctly the sounds of the chest through two garments, but under ordinary circumstances, it is best to auscult the patient clad only in a single garment of flannel or muslin.

The position of the patient for auscultation should be similar to that already directed for percussion, but the muscles and skin need not be drawn as tensely upon the ribs, for the pressure of the ear or the stethoscope against the chest will supply the effort performed by the muscles, and bring the parts as closely together as is desirable.

HEALTHY RESPIRATION.

The signs derived from auscultation are divided into those of the respiration, of the voice, of the cough, and lastly, of the heart. The signs of the respiration include both the modifications of the natural sounds produced by disease, and the rhonchi, or the new sounds, which are totally unlike those heard in the normal state. The latter class of signs are simple and readily learned; the former are more important, and are produced by deeply-seated alterations of the substance of the lung, producing a change in the density of its tissue. These signs are always attended with corresponding alterations in the percussion, and the resonance of the voice, which depend upon the same changes in the vesicular structure of the lungs, and in the condition of the bronchial tubes. They are thus learned, as it were, in connection; and the signs of the respiration are strengthened or disproven by the corresponding changes in the voice and the percussion. Hence we shall find it more easy to acquire them than it otherwise would be, for we may verify for ourselves at every step of the examination, and gradually acquire confidence in our powers of discrimination.

The morbid alterations of the respiration are well marked in extreme cases, but gradually pass into the characters of the healthy respiration; there is, therefore, but one way of learning these signs. It is, first to acquire the signs when strongly characterized, and then to proceed to the cases in which the modifications of respiration are but slight. In the diseased subject we shall find that the strongly-marked signs are very easily recognized; and many who follow practical demonstrations with sufficient attention, will naturally begin their study by the examination of patients who present these signs. Still, the facility for examining persons in health is so much greater, that I should advise all beginners to familiarize and train their ear by the attentive study of those sounds presented by healthy individuals which approach most nearly to the signs of disease. And they will find that the characteristic marks of the radical sounds exist both in health and in many diseased conditions.

These characters in healthy individuals are founded upon the peculiarities of the sounds in different parts of the chest dependent upon the differences in the tissue. The lungs consist of tubes conducting the air to vesicles in which the arterialization of the blood takes place. The sound of the air entering the vesicles is different from that caused by its passage through the tubes; the former is designated as the vesicular sound, the latter as the tubal or blowing sound.

The vesicular sound is often called a murmur, from its softness and diffusion over a large space, and cannot be produced unless the vesicles are healthy or nearly so. If you keep up artificial respiration in an animal stunned by a blow on the head, or suddenly killed, and apply your stethoscope upon the exposed lung, the murmur is heard very distinctly during the inspiration, so that we have direct evidence that the sound is produced by the passage of the air into the vesicles; the vesicles, however, empty themselves in a noiseless manner, and the expiration is therefore nearly unheard.

The tubal or blowing sound is quite different in its character; it is evidently produced by the passage of the air through tubes, and is heard very distinctly both in the inspiration and expiration,—and is, in fact, much more distinct in the latter. The

cause of this difference seems to be the different manner in which the air impinges upon the vesicles and tubes. During the inspiration the terminating point is in the air-vesicles, and the air, if forced into them with tolerable rapidity, produces a sound; this is the same, whether the impelling force be the pressure of the atmosphere upon the column of air in the bronchial tubes, when the parietes of the chest are elevated by muscular action, or the force communicated by the bellows, when artificial respiration is carried on. The sound is in part owing to the vibration of the air, and in part to the noise produced by the dilating of the vesicles themselves. At least the sudden dilatation of a partially collapsed vesicle is, in all probability, attended with sound caused by the membranes; for when the parietes of the vesicles are thickened, the sound becomes louder and more distinct. It is a point, however, which is difficult to decide, and one that is of little practical moment; for, admitting either explanation, it is equally necessary that the vesicles should be clear, and that the air should pass freely into them from the adjoining tubes.

The expiration produces a faint, vesicular sound—almost no sound in those portions of the lungs where the vesicular tissue is not traversed by bronchial tubes of a certain caliber. This probably depends upon the gradual manner in which the pressure upon the vesicles expels the air from them into the larger tubes through which it may readily pass toward the exterior; but as the air is forced out from the vesicles very slowly, and not in a regular stream or current, they contract without sound. The vesicular murmur is compared to various sounds not very like to it; but it can be learned only in one way—that is, by listening to those parts of the chest in which it exists in the greatest purity, especially toward the lower and lateral portions of the lungs. The murmur will be found to vary in intensity in different individuals: in some it is always feeble, and in others comparatively loud. It is louder in those persons of a nervous temperament in whom the necessity for rapid respiration is greater, than in stouter individuals. It is also stronger in women and in children than in men and adults. The vesicular sound is indeed so much louder in children, that the term puerile respiration is used as synonymous with loud and full vesicular sound.

In most persons, the dilatation of the vesicles is obviously incomplete, except in forced inspirations, and in some is much more so than in others. This imperfect dilatation is rather more marked at the lower portions of the lungs than the upper, probably from the longer course and smaller size of the bronchial tubes, which require a more powerful effort to produce their full distention.

The tubal respiration is often called bronchial, from its production in the larger bronchial tubes—or tracheal, from its development in the trachea—the term tubal being thus always confined to the most intense degree of this sound. In the healthy individual this may be heard in a very marked degree at the trachea, immediately above the sternum, and the air is then heard very easily as it passes through it, both in the inspiration and expiration. The sound is always blowing, and very different from the vesicular murmur; this character is best marked in the expiration. The cause of this difference will be very obvious if we attend to the sound of our own respiration; we will find then, if we breathe rapidly, that the expiratory sound, which is heard out of the chest, is much louder than the inspiratory, and that it is produced in the upper portion of the bronchial tree, and in the nasal fossæ, where the air-passages are large, and the rapidity of motion of the air is greatest. It is for this reason, in the trachea, the respiration is most decidedly tubal, or if we choose to use the term, tracheal. It gradually becomes less and less so as we approach more nearly to the parts of the lungs where the vesicular structure is most abundant, and contains tubes of the smallest caliber, and farthest removed from the surface. We may thus analyze the different sounds heard in various parts of the respiratory passages, and it will then be found that the blowing sound is heard alone at the trachea, and the vesicular alone at the lower part of the chest, while at the roots of the lungs there is a mixture of the two varieties of sound, so that the vesicular is combined with the blowing sound.

Passing from the root of the lung we find a gradual diminution in the loudness of the bronchial sound; but it is still heard as far as the summit, and much more distinctly on the right side than on the left. The difference in the two sides arises from their ana-

tomical structure; for the tubes leading to the upper part of the right lung are shorter and larger than those going to the left, on which side the large bronchus passes under the aorta, and is therefore much longer and more tortuous than upon the right. The larger but shorter tubes approach much more nearly than the longer and smaller ones to the physical condition of the trachea, in which the air circulates with such freedom as to give rise to the loudest double blowing sound.

The louder blowing sound exists on the right side, both at the anterior and posterior part; hence a given amount of induration of structure, which may tend to increase the loudness of this sign, will be much more perceptible on the right side than on the left; while, on the other hand, in the state of health, a perfectly natural peculiarity may be mistaken for disease. The blowing sound, if it be heard only on the right side, must be well characterized to become a sign of disease, and when it is slight is not of much value unless combined with other corroborative evidence.

This difference of respiratory sound on the two sides of the chest dependent upon the different structure of the lungs, was not pointed out previously to some researches which I undertook relative to this subject, at the Children's Hospital of Paris, more than twenty years ago. My attention was called to the difference in respiration by the observation made by my lamented friend, Dr. James Jackson, of Boston, who laid great stress upon the characters of the expiration observable in commencing phthisis, and other diseases attended with consolidation of the lung. His remarks upon early development of the blowing expiration in commencing phthisis were perfectly well founded; but at first he was sometimes led into error from not making due allowance for the difference of the two sides dependent upon peculiarities of conformation.

In the study of the respiration we have a plain course to follow: we must examine as often as possible the region of the trachea, and then the lower and vesicular portion of the lungs, and thus fix in our minds the difference between the two leading varieties of the respiration, or the tubal and the vesicular. Some may find this study a matter of no little difficulty, while others can seize the distinctive characters at their first effort.

They must not be in doubt as to the cause of this difference when it exists; it arises in part from a less acuteness of hearing, but much more from a defect of attention, which may be readily supplied by our own efforts; and, it must be admitted, that we know nothing of auscultation until we have mastered this subject. After the best-marked sounds are learned, we may proceed to those parts of the chest in which the two varieties of the respiration are heard at the same time; we then analyze their peculiarities, and may ask at each moment whether we have attained a clear idea of both sounds, as they are heard together. The same process should be repeated in different individuals of various ages, sex, and conformation; and we shall find that although they present numerous shades of difference, the radical features are the same, and must always be the same, for they depend on known principles of acoustics.

In connection with this part of our studies, we may properly enough accustom ourselves to the shades of difference offered by the parts of the lung where other viscera, such as the heart and liver, occupy a portion of the space beneath the ear, and we may in this way learn the abrupt manner in which the respiration generally ceases at the lower margin of the lung. During our examination we should direct the patient to breathe with different degrees of rapidity, sometimes quite naturally, and at others much more quickly, so as to force the air into the vesicles. In the examination of diseased individuals nearly the same order is followed; and, after placing our ear for a moment upon the chest of the patient, while breathing in a quiet and regular manner, we usually direct him to make a forced inspiration, which clears out the mucus in the bronchial tubes, and supplies a full proportion of air to each vesicle, or we direct him to cough, so that a forced inspiration may follow the expirations, which constitute the act of coughing.

In cases of disease of an acute character obstructing a portion of the lung, there is no necessity for directing the patients to breathe rapidly, as the obstruction in the diseased part of the lung causes the respiration in the rest of the pulmonary tissue to be much exaggerated or puerile.

MORBID RESPIRATION.

After learning the radical characters of healthy tracheal or bronchial respiration, which differ merely by a shade from those of the vesicular respiration, which is intermediate to the two leading varieties, we may proceed to the study of the morbid alterations of the respiratory sounds. These are classed according to their greater or less accordance with the natural characters of the respiration. They are the bronchial respiration and its varieties, which include the cavernous and amphoric respiration.

The *bronchial* respiration, as it occurs in a diseased lung, is essentially the same with the tracheal respiration of the healthy chest. The bronchial respiration is developed by causes which harden the parenchyma of the lungs, and destroy the vesicular texture: these are the infiltration of the tissue of the lungs with blood and plastic lymph in pneumonia, the compression of the lung by pleuritic effusions, and the deposits of various anomalous productions, such as tubercle and cancer, in the tissue of the lungs. If the induration be seated around the larger bronchial tubes, the bronchial respiration is generally much louder than in the portions of the lung where the tissue is chiefly composed of vesicles, for the essential cause of this sound is the passage of the air through the tubes. The induration of the substance of the lung develops the tubal or bronchial sound where it is not generally heard, and increases it in those parts of the lung in which it exists naturally. The bronchial respiration is produced then partly by the obliteration of the vesicles, and partly by the closure of the smaller tubes. That is, the air, in passing through the tubes of a certain size, is suddenly interrupted and repelled from their sides, because their terminating branches are closed. This repulsion of the air produces sound and causes the blowing inspiration and expiration, which is heard most loudly when the air, instead of diffusing itself throughout the vesicular tissue, is, on the contrary, forced through the larger bronchi, which are converted into closed cylinders, from the occlusion of their branches by the progress of the disease.

The bronchial respiration is often accounted for in the follow-

ing way: The passage of the air along the tubes is, under ordinary circumstances, not attended with sound; as the surrounding tissue is a bad conducting medium, and deadens the sound. When this tissue is rendered more solid, the sound already produced in the tube becomes audible, and is conducted to the ear. This explanation is valid only to a certain extent; the bronchial sound exists but in a slight degree in the natural state, for a tube through which the air is constantly and equally drawn during the respiration gives rise to a very faint sound. If the tubes passing into it, however, are cut off, the passage of the air is at once hurried, and by its friction against the parietes of the bronchus gives rise to the usual bronchial sound. In disease, therefore, the blowing sound is sometimes much louder in those portions of the lung where it does not exist naturally, than over the trachea or the larger tubes, which are almost immediately beneath the ear; and this extreme loudness depends upon the circumstance to which I have already alluded—that is, the sudden reflection of the column of air from the interrupted tube.

The bronchial respiration does not depend, as some have supposed, simply upon the fact that the vesicular respiration is destroyed, which of course renders the bronchial sound more audible. But the air, in passing through an indurated lung, is not only excluded from the vesicles, but impinges on the walls of the bronchial tubes with so much force as to be thrown strongly backward, in that way producing the bronchial sound as well as favoring its transmission. Hence it will be seen that this sound must occur when the bronchial tubes are large, and are not surrounded by the vesicular portion of the lung; and, in the second place, it is produced in positions in which it does not exist naturally, from the induration of the vesicular structure.

The large size of the tubes is, however, as I have already stated, a circumstance highly favorable to the development of bronchial respiration; and if the tubes be superficial, like the trachea, the influence of size becomes more obvious. If the tubes be enlarged, while the parenchyma remains healthy, the respiration becomes bronchial, but to a less degree than if the tissue be hardened, and the tubes retain their usual caliber; for the indura-

tion is a more efficient cause of bronchial respiration than simple enlargement of the tubes.

The bronchial respiration is not perfect except when the induration of the pulmonary tissue is complete; this takes place in a few cases of phthisis, and in pleurisy with large deposit of lymph, but it is much more frequent in pneumonia than in any other disease, for in none other is the hardening of the tissue so perfect: this sign is therefore one of the best indications of the second stage of inflammation. In dilatation of the tubes the respiration becomes very bronchial when the surrounding tissue is indurated, especially when it is complicated with pneumonia.

The bronchial respiration, then, is produced by the passage of the air through tubes of the middle and larger size in an indurated lung, and also by the enlargement of these tubes.

The *cavernous* respiration is another variety of sound which is closely analogous to the bronchial respiration, and depends upon the passage of the air into a cavity communicating with the bronchi. For physical purposes this cavity may be considered as a mere dilatation of the bronchus with which it communicates; but as the termination of the tubes themselves is never so abrupt as the morbid cavity, the air in the bronchial respiration proper is gradually diffused through the tissue, and is slowly lost to the ear, but in the cavity it is abruptly reflected from the walls of the excavation, and therefore seems to be more circumscribed, and to come from a limited point. This diffusion of sound in the one case, and the concentration of it in the other, constitute the principal difference between these varieties of forms, and they therefore run into each other by insensible shades. As the line of distinction is an arbitrary one, it is sometimes impossible to discriminate between them; but it is not generally a matter of much practical moment, for the signs of a cavity generally become more and more distinct in proportion to the duration of the disease, and these which seemed doubtful, usually become clear in a short time.

I am not, indeed, accustomed to lay a great deal of stress upon the distinctions between cavernous and bronchial respiration in many cases. For, as I have already mentioned, a cavity in the

lung may be regarded as a simple dilatation of a bronchus; it is very evident that the signs must frequently be very similar, or even perfectly identical. Thus it is always found that if three or four persons auscult a moderate-sized cavity in the lung, containing no liquid, there will be almost as many different opinions as there are auscultators. If there be no liquid in the cavity, one observer will call the respiration bronchial; another, cavernous; and the principal reason why the term cavernous is applied in cases of this kind, is found in the knowledge of the fact that cavities are formed clear of liquid, particularly at one portion of the lungs. Hence he who pronounces the respiration to be cavernous at a given spot, frequently does so, not because there is any well-marked line of difference between them, but from his knowledge of the different causes of these sounds.

It is true, that when the cavity has attained a certain size, there is often a well-marked line of distinction between cavernous and bronchial respiration; but this applies only to cavities of at least the size of a pigeon's egg, or larger. When they are smaller than this, I always consider the cavernous respiration which they produce to be so nearly identical with bronchial respiration, that I rely more upon the evidence of other signs demonstrating that these are cavities, than upon the characters of the respiration.

Practically, however, there is no great cause of difficulty from confounding these two signs. The only disease in which confusion may occur is pulmonary phthisis; and here it does not much matter whether the sound be bronchial from tubercular induration of the lung, or slightly cavernous from the formation of a small cavity.

I am induced to insist upon this, from constantly seeing mistakes made by gentlemen who are conversant with auscultation, from their forgetting the fact that a small cavity may be physically regarded as simply a dilated bronchus, and that bronchial respiration produced in a tube of the natural size, passing through an indurated lung, will, especially at the upper portion of the chest, give rise to almost as loud a sound as if a cavity existed.

The *amphoric* respiration is a modification of the same sound,

but is more unlike the bronchial respiration. It is produced by the passage of the air into a large cavity with firm walls. If the communication between the cavity and bronchi be free, the expiration is also loud, and the signs differ from the cavernous respiration in one respect only—it is fuller and more musical, somewhat similar to the sound caused by blowing into a glass or metallic vessel. Both the inspiration and expiration are blowing, and there is no trace of the vesicular murmur. If the communication with the bronchi be interrupted, or too small to allow of the free passage of the air, the inspiration alone is distinctly heard, as the air passes out of the cavity too slowly to produce much sound. The most common cause of amphoric respiration is a large tuberculous cavity near the surface, which is surrounded by indurated lung. It may also depend upon perforation of the pleura; in which case the amphoric tone is extremely well marked, as the cavity is much larger than one formed in the lungs, and its walls are large and elastic. If the amphoric respiration depends upon a gangrenous cavity, it generally renders the sound more obscure, so that it is less marked than in tuberculous excavations, as the surrounding tissue is usually soft, and is therefore a bad conductor of sound.

Amphoric respiration, as a clear, unequivocal sign, is not very common. In most cases, large cavities produce simply a cavernous respiration; but the peculiar intonation looked upon as characteristic of amphoric respiration is only occasionally heard. When the respiration has the proper amphoric character, it is less loud than the cavernous; the air seems to diffuse itself more gradually and equally in a large cavity, and it, as already mentioned, produces little sound during the act of expiration.

We now return to the bronchial respiration as our standard of comparison, and pass from it to the vesicular murmur, reversing the order we have just followed. The varieties of the respiration intermediate between the vesicular murmur and the true bronchial respiration are very numerous; but they are properly enough classed under the general designation of *rude* or *rough* respiration, which is applied to those varieties in which the vesicular murmur is still retained, but the blowing sound is at the

same time more developed than is natural in the part of the lungs where it is heard. It may be attended with a feeble or an increased loudness of the vesicular murmur. When this is more feeble, the obstruction to the air occurs about the smaller tubes, and gradually compresses them; when loud, the morbid deposit is situated rather in the course of the larger tubes than at their terminating branches, which still receive their full supply of air while the respiration becomes blowing, from the increased conducting power of the hardened tissue.

It is very necessary to pay attention to the differences in intensity of the vesicular sound in rude respiration. As I have already mentioned, when there is a gradual obstruction to the air about the smaller tubes and also the vesicles, the force of vesicular dilatation is much diminished, and at the same time the respiration may be decidedly rude. It is always the case in effusions into the pleura, and frequently in pneumonia and phthisis. But there are other cases, in which rude respiration coincides with increased loudness of the vesicular murmur. That is, in cases where there is but a partial obstruction of some of the bronchial lobules, while the air passing into the lung is diverted with increased force into those which remain pervious, of course in this way increasing the loudness of the vesicular respiration.

This modification of the rude respiration occurs frequently in the lung which remains healthy while the other is diseased; for the air being driven through the bronchial tubes with increased force, must always produce a roughness of sound in the larger ones; while at the same time a puerile respiration is heard distinctly throughout the whole of the unaffected lung.

The rude respiration is one of the most interesting varieties of the respiratory sound, for it occurs in those cases in which the lesion is not yet much advanced, and a portion of the pulmonary tissue remains permeable to the air; hence it is a sign of the earlier stages of phthisis, as well as of the commencement of pneumonia and of pleurisy. It is a sign which can only be learned with some difficulty, because both the primitive sounds of the respiration are present, and they can only be separated by a careful analysis.

From the rude respiration we naturally return to the *vesicular*

murmur, which may be exaggerated, or enfeebled, but still retain its essential characters. The exaggerated or puerile respiration generally depends upon disease in other portions of the lungs than those in which it is heard. The healthy portions then perform double duty, and arterialize more than their proper share of blood. From the occurrence of puerile respiration in a part of the lung of a patient who labors under dyspnœa, we can very often determine that some obstruction must exist in other parts of the lungs; and from the knowledge of the acute and chronic diseases which generally give rise to this obstruction, we can with tolerable certainty discover the nature of the lesion. The respiration is rendered feeble in disease, either by the compression of the vesicles from effusion upon the exterior of the lung, or the development of solid matter in the parenchyma, or, lastly, from obstruction of the smaller tubes.

There are some other varieties of the respiration which it would be difficult to bring within a systematic description; they should be learned after the leading varieties have been first studied. They generally arise from slight changes in the condition of the vesicles or smaller tubes, and sometimes from the mode in which the respiration happens to be performed, but rarely depend upon important organic changes in the lung. They may be reduced to the following: 1. The incomplete or interrupted respiration; in this variety the inspiratory sound seems to be arrested before the air passes completely into the vesicles; it arises from two causes—a nervous spasm, and a partial thickening or congestion of the smaller tubes. It is a peculiarity which is often observed when we examine for the first time a nervous, sensitive patient, who is alarmed by the exploration of the chest; and it is sometimes met with in the infiltrated or congested state of the lungs which attends the forming stage of tuberculous disease, as well as certain varieties of bronchitis. 2. The rustling sound of the respiration is one of the characteristics of emphysema, in which the vesicles dilate and contract with difficulty, and seem to produce sound rather from the rustling of the membrane than from the passage of the air which strikes against it. There are other and slighter deviations from the natural tone of the res-

piratory murmur; but, although they are very obvious to an experienced ear, yet they are neither sufficiently permanent nor well marked to be reduced into a systematic classification.

OF THE VOICE.

The varieties of the respiratory sound correspond with varieties in the resonance of the voice, which often are nearly as well characterized; still, the natural tone of the voice has so much influence upon its aptness for vibration, that the signs are not always as perfectly distinctive as those of the respiration.

Besides, as the signs of the voice merely afford an additional proof of the character and stage of the disease to those derived from the respiration, it is less necessary to insist so strongly upon them, especially as they are much less full and decided than those of the respiration. Hence, although I am always accustomed to examine them for additional evidence of disease, yet I am very far from regarding them as so full or clear in their indications as are those of the respiration.

In the ordinary act of speaking the voice vibrates throughout the chest, and if the hand be placed upon its parietes a slight tremor is very perceptible; if we apply one ear to it, we hear a thrilling but distant and confused sound. This sound becomes louder, and is brought nearer to the ear, if we listen near the summit of the lungs, especially on the right side, or at their root; and placing the stethoscope upon the trachea, or, still better, on the larynx, we find the resonance loud, and the words pronounced nearly as distinctly as they are by the mouth. In fact, the voice is conducted by the column of air, so that articulated words seem to enter the ear from the trachea. This distinct and loud resonance at the trachea is almost exactly similar to pectoriloquy; and it is in this situation very perfect, especially if the voice of the individual be naturally clear, and rather shrill. At the sternum, and at the root of the lungs, between the scapulæ, the resonance is less perfect, and the voice seems to enter the ear less completely than in pectoriloquy; it is therefore not quite so well characterized a sign, and is called, from its position, bronchophony. In the rest of the lung the resonance of the voice is

gradually less and less loud as we pass from the bronchi to the vesicular structure, where we hear nothing but a faint vibration.

There is, therefore, a uniform relation between the voice and the respiration, the resonance of the voice being greatest when the blowing sound of respiration is most intense. In disease the same proportion exists; a cavity gives rise to cavernous respiration in breathing, and to pectoriloquy in speaking,—and a consolidated lung, especially around the large bronchi, produces bronchial respiration and bronchophony. The same relation exists between a mere loud resonance of the voice and rude respiration, and between the ordinary vesicular murmur and a slight thrilling vibration of the voice. In cases in which the murmur is enfeebled, the resonance of the voice is less; but sometimes there is a low, purring sound, communicated to the ear as well as the hand, which is analogous to the rustling sound of emphysema, and depends upon the same causes. The blowing respiration may continue very loud when the resonance of the voice has become quite feeble, for an accumulation of mucus may be forced aside by full inspiration, but cannot be thrown out of the way by the act of speaking, and therefore obstructs the vibration of the column of air; in these cases it is not, however, totally destroyed, for the sound of the voice is conducted by the hardened lung from the neighboring tubes.

There is often but a slight distinction between bronchophony and pectoriloquy; because for the production of perfect pectoriloquy precisely the same condition of the lung must exist as is required to produce a distinct cavernous respiration. That is, the cavity must be of but moderate size, free from liquid, and not broken up into anfractuosities. Besides, the cavity should be near the surface of the lungs, and should communicate freely with the large bronchial tubes. Hence this sign is met with under precisely the same circumstances as pure cavernous respiration. Now as these conditions are very far from occurring in all cases of cavities, pure pectoriloquy is rather a rare sign. I am, therefore, accustomed to speak, in many cases, of cavities in the lungs as producing simply bronchophony or even merely an increased resonance of the voice, though I may be able to define the size of the cavity and its form by the signs of respiration.

Bronchophony is found to exist in almost every case of phthisis, especially at the summits of the lungs, where tubercles are most abundant. It varies, however, in its degree of perfection; sometimes it is loud and distinct, at other times, when some of the lobules remain previous to the air, or the bronchial tubes are obstructed by a large quantity of mucus in them, bronchophony may be imperfect.

The sign is, however, produced in its greatest perfection in cases of pneumonia advanced to the second stage; for then the perfect induration of the lung, surrounding bronchial tubes in which there is comparatively little liquid, furnishes us precisely the best circumstances for developing bronchophony. Sometimes this sign seems to be almost concentrated, so that it may be mistaken for pectoriloquy; for, after all, the distinction between these two signs depends chiefly upon the diffusion of the one and the concentration of the other.

Bronchophony is also heard in perfection in cases of acute phthisis, where a sudden deposition of tubercles occurs; or in fact, in any case of this disease in which a large deposit of tubercles has occurred with comparatively little softening, no cavity having as yet been formed.

Dilatation of the bronchial tubes, although a very rare disease, gives rise to bronchophony when it exists. Sometimes this sign may be so perfect as to be mistaken for pectoriloquy in those cases; that is, if it occurs at the summits of the lungs, where pectoriloquy is usually looked for, and where bronchophony, from any cause, is generally ranked as pectoriloquy, simply from the mind of the observer being convinced that the sign is due to the presence of a cavity.

Imperfect bronchophony is found in all cases in which there is a partial consolidation of the lung. Hence it occurs in the early stages of phthisis, in pneumonia advanced only to the first stage, or still confined to the central portions of the lung. It is also found in cases of pleurisy, especially when the liquid is thick and tenacious; in fact, it exists in the lungs wherever there is an imperfect consolidation of the part; and therefore it is a sign of a certain degree of value.

In all cases, however, in which we auscult the voice of a patient,

we must remember that the resonance of it is modified very much by its depth and quality of tone. Thus its resonance is less loud and distinct in cases in which the voice is deep, and the thorax large and capacious, than it is in those individuals whose natural voice is to a certain degree sharp, and the chest comparatively narrow.

When a cavity in the lungs is very large, there is, of course, amphoric respiration. On careful examination we then find amphoric resonance of the voice, which often scarcely differs from pectoriloquy; that is, if the cavity be not much larger than a hen's egg, and its walls remain firm. But if the cavity increase much beyond this size, the resonance of the voice is extremely metallic, or has a clear ringing sound, which, like the respiration, is very similar to that produced by speaking in a glass bottle without quite closing its mouth—at the same time the voice is less loud than in pectoriloquy, so that it is not unfrequently difficult to ascertain that it is really amphoric.

When the large cavity is situated in a soft permeable portion of the lung, the amphoric respiration may become very obscure, like the resonance of the voice under the same circumstances.

The bronchial respiration which results from pleuritic effusions is not very loud, but differs so slightly from the other varieties that it is usually not separated from them, while the resonance of the voice which takes place under the same circumstances is very different. Its vibration is very great, and is so peculiar that the sound is called egophony, from the bleating tone of the voice, somewhat similar to that of a goat or sheep. This is not an invariable result of pleuritic effusions, but it is produced in almost all cases in which the quantity of liquid is sufficient to compress the lung without entirely flattening it out. If the quantity of liquid happens to be very great, but the lung is stiff and more solid than usual from previous inflammation of its substance, the egophony continues longer than it otherwise would do, and rarely ceases during the course of the disease. In these cases, however, the egophony is in fact merely a modified bronchophony; that is, the latter sign has a tone of vibration which resembles in some respects ordinary egophony, and furnishes a distinctive difference between itself and ordinary bronchophony.

Egophony is, however, in the large majority of cases a very transitory sign, ceasing generally in a few days after it has been heard. Sometimes the sign is only perceptible for a single day, disappearing as soon as the quantity of liquid is increased; for the voice has this character only when there is a moderate effusion. In other cases we do not recognize the sound at all, throughout the whole course of the disease. In a few individuals the voice is egophonic for a very long period; but these are quite exceptions and very rare cases. We generally hear egophony most distinctly, when it is present, by listening when the patient speaks, near the lower margin of the scapulæ; that is, about the upper portion of the effused liquid. But sometimes it is also heard along the inferior and anterior portion of the chest; it then follows very nearly the line of a moderate effusion of liquid, disappearing when the liquid becomes more abundant. Hence it is not usually heard at the lowest portion of the chest.

The cause of this modification of the voice is very difficult to explain; it is somewhat like bronchophony, and probably arises very nearly from an analogous condition of the compressed lung to that which is found in cases of inflammation; then the lung is slightly indurated from the compression, and the air is afterwards thrown into a peculiar resonance by passing through the effused liquid.

The signs of the voice are learned by the same process as those of respiration. After having acquired a good general idea of the characters of the respiration, we should examine them in connection with the signs of the voice, confirming or disproving one by the other, and then practicing percussion, which will throw additional light upon the subject. We need not, of course, restrict ourselves to the healthy subject, but we would also study those cases of diseased lungs in which the diagnosis is comparatively easy from the functional signs alone, such as examples of decided phthisis and pneumonia, and then search for cavernous and bronchial respiration, with the connected signs of the voice and percussion.

The cavernous resonance of the voice in pectoriloquy was the first physical sign discovered by Laennec. He happened to place some paper, rolled up into the form of a cylinder, upon the chest

of a patient, in order to feel the pulsations of the heart, when he was surprised to find that, during the act of speaking, the voice of the patient seemed to enter his ear. He examined immediately the chest of a large number of patients in the same way, and detected the same phenomena in a great number who were evidently laboring under advanced phthisis; the cause of this was afterwards found to be cavities in the lung communicating with the bronchial tubes. Pectoriloquy was divided by him into three varieties—the perfect, the imperfect, and the doubtful; in the perfect, the voice seemed to pass through the stethoscope (which Laennec always used) to the ear, in the second to enter the tube, and in the third the resonance was quite confused. These distinctions are of little value, and rather tend to confuse our ideas. In fact, Laennec for a long while confounded together pectoriloquy with the modifications of the voice afterwards called bronchophony. He entertained toward this sign something of a paternal feeling, from its being the first one acquired by him, which afterwards led to such splendid results. Hence he was always accustomed to attach too much importance to it.

The following table will give you the relation between the voice and the respiration:—

Amphoric Respiration,	Amphoric Resonance of Voice,
Cavernous Respiration,	Pectoriloquy,
Bronchial Respiration,	Bronchophony,
Rude Respiration,	Strong Resonance of Voice,
Vesicular Respiration,	Slight Thrilling of Voice.

THE RHONCHI.

There are a number of sounds produced by the respiration in certain states of disease of the chest, which are totally unlike the sounds heard in health. These sounds are called the rhonchi; and they are mainly produced by impediments to motion of the air in the bronchial tubes. Those which belong to the lungs proper are caused by obstacles to the passage of the air through the bronchial tubes; these are the most interesting and important of the class.

Friction sounds. There is another set of sounds to which the

term rhonchi is sometimes applied, but which differ in some respects from them. More properly they are known under the name of the friction sounds of the chest. They arise from the friction of the serous membranes in the chest, and are common to both the lungs and the heart. They occur when the effusion in these membranes consist chiefly of lymph which coats the surface of the serous tissues sufficiently to cause a slight creaking sound. This creaking or friction sound in the pleura takes place during both inspiration and expiration, but especially at the commencement of the expiration, when the ribs first begin to sink down, and the pleura is drawn rapidly over them. It is not limited to a single spot, but shifts about with the dilatation and contraction of the chest; and is generally most evident about the lower angle of the scapula, and often extends from that point across the axilla to the sternum. It is a sign which is proper to pleurisy, either primary or secondary; and it is in general readily recognized after the bronchial rhonchi are known, especially if the friction be sufficient to give to the parietes of the chest a thrilling motion, which may be felt by the hand.

The friction sound in pleurisy occurs as soon as the disease begins, but afterwards usually disappears if there be much effusion. It returns again, however, with the absorption of the liquid, and remains until perfect recovery; sometimes indeed it is heard for a long while after the patient is entirely well, simply because the consolidation of the false membranes, although perfect, is not sufficient to closely unite them. Hence a little jerking or rubbing is produced during each act of inspiration and of expiration. I have detected this sign years after the patient has recovered from an attack of pleurisy.

The friction sound is not always easily detected at first; if, however, the ear be carefully passed along the chest at about the junction of the middle and lower thirds of the lung, it may be heard. Sometimes it is confined to the posterior portion of the chest, or it may be found only in the anterior part, or it may affect both these localities. It may be found wherever the serous membrane, covered with lymph, drags or grates during the act of respiration. The sound may be readily distinguished from the proper rhonchi by attending to the irregular course which

it follows, which does not coincide with the direction of the bronchial tubes.

The pericardial friction sound is produced much in the same manner as that which occurs in the lungs. It is heard between, as it were, the contraction and dilatation of the heart. Sometimes these sounds are like those of the pleura, but they may be loud. Very often, however, they are comparatively slight. They may be recognized very easily by paying attention to the moment at which they appear, synchronous with the heart's action, and not with the act of respiration; besides that, the intonation of these sounds is also in some degree different in the two cases, although they both depend upon the same cause, that is, friction of the serous membranes from the presence of lymph.

The rhonchi, properly so called, are divided into the moist and the dry. The moist rhonchi are the mucous, including the gurgling of cavities, the subcrepitant, and the crepitant. The dry rhonchi are the sonorous and the sibilant, to which may be added the dry crepitant.

The *moist rhonchi* are caused by the resistance offered by a liquid in the tubes or vesicles to the passage of the air; the liquid forms bubbles of various sizes, and their successive breaking is the chief cause of the rhonchus. The dry rhonchi are produced by real thickening or spasmodic contraction of the mucous membrane, which gives a musical tone to the respired air; they are most evident in the expiration, while the moist rhonchi are for the most part heard during the inspiration. The rhonchi are not necessarily permanent, except the crepitant rhonchus; for the obstructions forming mucous rhonchus, or the thickening of the larger tubes, may be removed for a time, in many cases, by an effort of coughing.

The *mucous* rhonchus is the loudest of the moist rhonchi; it is caused by the breaking of bubbles of tolerable size contained in the larger tubes; the sound is readily enough recognized, and is scarcely ever mistaken, even on a first examination. This is the sound which is often audible at a little distance from the chest of the patient, especially if it extend over a large portion of the lungs. The mucous rhonchus is heard wherever there is an abund-

ant secretion of liquid into the larger bronchi, and this generally arises from the second stage of bronchitis; it is also quite common in phthisis and the third stage of pneumonia; and the blood which is poured into the bronchi in hæmoptysis may give rise to almost the same phenomenon. The mucous rhonchus is generally heard both in the inspiration and expiration, that is, when the air returns with sufficient force from the lungs to agitate the liquid, and form bubbles; as a general rule, however, it is heard chiefly during the inspiration.

There are two varieties of the mucous rhonchus which are almost peculiar to phthisis; these are the dry crackling produced by the softening of the thick, pasty matter of tubercle, which gives a peculiarly dry and sharp sound, and the loose but concentrated gurgling of a cavity. Any disease which gives rise to a cavity in the substance of the lung will produce this cavernous gurgling; thus it may arise from gangrene of the lungs, pneumonia, or even a dilated bronchus. But as cavities depend much more frequently upon phthisis than any other cause, probably forty-nine out of fifty of those which we meet with may be referred to softened tubercles. The gurgling differs from mucous rhonchus merely by its greater concentration; it is in this respect that, like the other signs of cavities, it is distinguished from those of the bronchi; and it passes into mucous rhonchus by an insensible gradation. We may place, therefore, the dividing line between the mucous rhonchus of small cavities and of the bronchi where we please. Large cavities can never be mistaken. But there are some cases of dilatation of the bronchial tubes which extend over a considerable portion of the lung, in which the secretion of liquid is abundant, and the mucous rhonchus very similar to that of an ordinary tuberculous cavity. The liquid gurgling is heard both in the inspiration and expiration, for the air is reflected from the sides of the cavities during expiration, and of course causes an almost continuous rhonchus. You will find that both the crackling and gurgling are liable to disappear, although the cavity remains; for the liquid secretion may be for a time suspended, or the matter may be expectorated, and the walls of the cavity may for a while remain dry.

The character of the mucous rhonchus is to a certain degree

dependent upon the disease producing it; thus the mucous rhonchus of the third stage of pneumonia has never the same intonation as that of ordinary bronchitis; for in pneumonia the induration of the lung and the peculiar character of the liquid modify the sound of the rhonchus. In like manner in bronchitis, although the size of the bubbles and the loudness of the rhonchus itself vary very much, yet there is a certain degree of similarity in all cases of this disease. In phthisis, however, the mucous sounds dependent upon softened tubercles, although they generally present a peculiar intonation, are yet modified by the fact of the accompanying bronchitis being well marked. Hence we have a mixture of signs even greater than exists in pneumonia.

The same remarks may be made concerning other diseases of the chest, in which a liquid is found in the bronchial tubes. In each of them we find some variety of mucous rhonchus; but the sign is to some degree modified by the nature of the disease and the character of the secretion.

The *subcrepitant* rhonchus differs from the mucous in two respects: the bubbles are finer, and they break in a more gradual and regular succession. The rhonchus is therefore confined to the smaller tubes, through which the air passes rather slowly, and the bubbles nearly fill up their caliber. It is heard in various parts of the lungs, but much more frequently at their lower and posterior part than elsewhere, for the liquid accumulates there in the smaller tubes more than in any other part. The subcrepitant rhonchus is heard very faintly during the expiration.

The subcrepitant rhonchus may be looked upon as in most respects a diminutive of the mucous; it is heard under nearly the same circumstances, but the bubbles are finer, and it is produced in the smaller tubes. It is therefore a sign generally looked upon as evidence that the disease has extended more completely throughout the lung. It is heard in cases of extensive bronchitis; and also in cases of pneumonia in which the liquid has passed into the finer tubes; in cases of tubercular disease, when softening has commenced, and also in cases of hæmoptysis. It is, in fact, heard in any disorder in which the tubes of less than the fourth or fifth subdivision contain liquid; varying, however, in the degree

and character of the loudness in proportion to the size of the tubes and the greater or less tenacity of the liquid. Thus in the third stage of pneumonia, the subcrepitant rhonchus is sometimes quite small, and the bubbles are always of a certain size when they burst. In the finer kinds of bronchitis they are larger, and resemble to some extent those of the mucous rhonchus. In phthisis, again, they have sometimes a dry intonation, at other times they are comparatively loose, according to the greater or less tenacity of the liquid. In hæmoptysis, again, the bubbles are fine, and seem to be produced by less resistant liquid than that in the varieties of disease just mentioned.

The *crepitant* rhonchus is one of the most interesting of the moist rhonchi. It is either fine or coarse, the latter variety differing very slightly from the subcrepitant. When the crepitant rhonchus is fine, it is pathognomonic of the first, or, still more, of the second stage of pneumonia, and it is then produced without them in the vesicles of the lung, and in the small tubes which ramify through the lobules; but when it is extremely fine, the sound is generally considered strictly vesicular, and seems to depend upon two causes—the breaking of the minute bubbles of thick mucus, and the dilatation of the thickened and stiffened vesicles. If the crepitus be rather coarse, it constantly arises more from the smaller tubes than from the vesicles, although this is a point which is not susceptible of a rigorous demonstration.

Crepitant rhonchus, however, I am now convinced by extended observation, is a sound almost entirely produced in the finest tubes, and not in the vesicles. The reasons for these conclusions are as follows: First, the crepitant rhonchus is very capable of being produced when the lung is perfectly solidified in pneumonia; it may be so solid in some of these cases, that when looked at, no one could imagine that any air could enter the tissue. In these cases, however, when the patient is ausculted, sometimes crepitant rhonchus is heard whenever the patient takes a full breath; at other times it is produced only by a strong effort of coughing; that is, after the mucus which has filled up the smaller tubes has been removed sufficiently to allow the air to pass down to the bronchi. The sound of the bubbles is then very fine, which I can readily account for on the supposition that the air opens

out the tenacious mucus in the fine tubes. Secondly, the crepitant rhonchus occurs also in cases in which the lung is still in the first stage, and is not of course perfectly consolidated; this condition of things is that which has caused this rhonchus to be looked upon as having its seat in the vesicles of the lung. But even in this case I consider it a matter of doubt whether it is really a vesicular sound, for the passage of air throughout the finer tubes might produce it, in the same way as already mentioned. Besides this, crepitant rhonchus is less a sign of the first stage of pneumonia than of the second; it exists, however, in both.

A crepitant rhonchus is a sign which is connected with the parenchyma of the lungs, and can never occur in the larger tubes. It is not produced by other diseases of the parenchyma than pneumonia, because it is only in the latter disease that we find the thick, viscid secretion, which produces crepitation in the first bronchial ramifications. The pure crepitant rhonchus is almost strictly confined to the inspiration; the air does not pass in the expiration with sufficient rapidity to break the tenacious liquid in such a manner as to produce a distinct sound. Besides, the force of the air inhaled is much greater than that of the air exhaled from the lungs. Therefore the fine bubbles are produced by the force with which the air is driven through the thick secretions in the finer tubes. But it is not so loud or distinct, because, in the first place, the air, although it strikes against the interior of the tubes, can scarcely be said to pass into the vesicles of the lung in pneumonia. Hence the sound is produced more by the impinging of the air against the mucus than by the opening out of the vesicles, which are either full of liquid in the first stage of pneumonia, or indurated in the second. Thus the sound is very nearly single. In the second place, the crepitant rhonchus is produced always in the finer ramifications of the bronchial tubes,—another reason why the sound is confined merely to the inspiration.

The crepitant rhonchus generally forms trains of bubbles, something like the successive explosion of a small train of wet powder; and the sound is compared to various trivial noises, such as the crackling of salt, and the rubbing of a lock of hair; but, like all the signs of auscultation, nothing out of the body gives a correct

idea of its character. We must, therefore, learn it in patients laboring under pneumonia; and if we have not opportunities for examining cases in connection with persons who are familiar with physical signs, I would advise those engaged in this study to select a case in which the pneumonia is advanced to the second degree, and the general symptoms of the disease accord with the physical signs. In such cases, the diagnosis of the disease may be regarded as quite certain; and we may trace the crepitant rhonchus as it proceeds from the internal portions of the indurated lung toward the exterior, and is heard simultaneously with bronchial respiration.

There are certain sounds connected with the pleuræ which are similar in many respects, as I have already stated, to the moist rhonchi. These are two in number—the friction sound, and the metallic tinkling which is heard generally when the external air communicates with the cavity of the pleura, but is occasionally observed in cases of large cavities in the substance of the lung. The friction sound differs in some cases very slightly from the subcrepitant, and I have sometimes been puzzled to discriminate between them; I do not, however, allude to the well-characterized variety, in which there is a thrilling motion extending along the chest, and felt as well as heard, but to those cases in which the friction is very slight. The deposit of lymph is then generally very small, but such is not necessarily the case, for there may be little friction when the effusion is large, especially if the lung be separated from the pleura by serum, which prevents the two surfaces from coming much into contact. The best method of distinguishing the slighter variety is to attend to the manner in which it follows the act of respiration; in the true subcrepitous rhonchus the bubbles break regularly and follow the passage of the air; in the slight friction sound there is not this regularity, and its position is never as permanent; there are, besides, generally some collateral circumstances, such as the existence of the subcrepitant rhonchus in other parts of the lungs, which will aid in distinguishing the two sounds.

The *metallic tinkling* is a peculiar sound produced by the escape of bubbles of air from beneath a stratum of liquid, situated in a cavity whose walls are firm and elastic. The liquid must occupy

only a portion of the cavity, the upper part remaining filled with air. It was supposed that the sound was caused by a drop of liquid which fell from the upper surface of the fluid. Dr. Bigelow, of Boston, suggested the explanation which is now commonly received, that the sound is not caused by the fall of a drop, but by the bursting forth of a bubble of air from beneath the liquid. This is the case, but it is not necessary that the air should be driven forcibly through the bronchial tubes; a very small portion of air contained within the liquid is sufficient to give rise to the tinkling. The sound is called tinkling, because it is somewhat similar to the tinkle produced by striking with a pin, or some other light piece of metal, upon a glass vessel. It is always heard in connection with the amphoric respiration, which depends upon the physical condition necessary to produce it. The sound, therefore, is not of great practical value.

The *dry rhonchi* are the sonorous, sibilant, and the dry or rustling crepitant; the latter of these is of very little value, and hardly differs from the rustling sound of the respiration, to which I have already alluded. They are, for the most part, heard chiefly during the expiration, and are caused by temporary or permanent thickening of portions of the mucous membrane of the larger or smaller tubes. In the large majority of cases they are heard in the earlier stages of bronchitis, before secretion has occurred, or in the chronic stages of this disease in which the secretion is not sufficient to remove the swelling of the membrane. But they may depend on a purely spasmodic state of the bronchial tubes, for there is no doubt that these tubes are occasionally subject to spasmodic action.

The *sonorous* rhonchus is generally very loud and well marked; few can have ever heard it without recognizing it merely from description. It is a loud, cooing sound, somewhat similar to that caused by drawing the bow slowly over the bass string of a violin, or to the cooing of pigeons. The sound may be compared most exactly to the note of the violin; but the rhonchus itself is so peculiar from its deep musical tone, and so unlike any other sound heard in the chest, that we can scarcely mistake it. It is most frequent along the upper part of the lungs, both anteriorly and posteriorly, and cannot be produced except in the larger

bronchial tubes, for the smaller ones do not yield so deep a note. In acute bronchitis, and even in the chronic cases of this disease, this rhonchus is so fugitive that it sometimes ceases and returns almost with every act of respiration. But we can generally find it in some portion of the lungs, although it may not remain long in a single spot. It is, however, not always so movable. In the numerous cases of secondary bronchitis which attend the diseases of the lungs and various acute disorders, the sonorous rhonchus is frequent, but it is not found in the most severe and dangerous cases of these disorders, or at least not exclusively. It is in all cases a sign of bronchitis, and when not connected with the moist rhonchi, generally indicates a mild form of the disorder.

The sonorous rhonchus sometimes resembles to a certain degree the sound of bronchial respiration, so that I have often found students of auscultation mistaking the one sound for the other. This, of course, cannot be done when the rhonchus has a distinct musical intonation. Sometimes, however, this tone is not very well marked; and as this rhonchus is often double, that is, heard in both inspiration and expiration, it is very obvious that the sign may sometimes be confounded with bronchial respiration. This, however, can never be the case unless the musical intonation is not very loud. If any doubt should exist in the mind of an observer, he may at once resolve it by percussion. If this be clear at the portion of the chest where the sonorous rhonchus is heard, it is very plain that it is not bronchial respiration. Besides, if the vesicular respiration be carefully sought for, it may usually be detected in all cases where there is sonorous rhonchus.

Occasionally we have sonorous rhonchus combined with bronchial respiration; for the thickening at the points of bifurcation of the tubes may coincide with the induration of the lung. Cases of this kind also must be resolved by percussion. If we find this flat, we know that the lung is indurated, although the characteristic bronchial respiration may be to a certain degree confused, in consequence of the development of the sonorous rhonchus.

The *sibilant* rhonchus bears the same relation to the smaller tubes that the sonorous does to the larger; it is a low, whistling

sound, heard principally, but in general not exclusively, during the expiration. Generally it is very short and variable in situation. Of course we may find it in those portions of the chest where the bronchi are rather small, and, at the same time, are not subject to accumulations of secretion—that is, at the anterior margin of the lungs. The sibilant rhonchus is chiefly heard in the various stages of bronchitis without effusion, especially in the chronic dry catarrh, and in almost every case of the secondary bronchitis of typhoid fever.

This sign is only interesting as a matter of curiosity to the physician. It is always changeable, shifting about from one part of the lung to the other, and indicates either a slight degree of inflammation, or of congestion of the smaller tubes.

Both these dry rhonchi are easily learned from this description alone, for they have a sufficiently close analogy to the sounds which are selected as objects of comparison. Thus, the deep bass note and the musical tone are quite characteristic of the sonorous rhonchus, while a whistling and slightly musical sound are equally distinctive marks of the sibilant. The latter rhonchus is even more movable than the sonorous, and is extremely irregular in its time of reappearance.

The *dry subcrepitant* rhonchus is a sign rarely met with, but is occasionally heard in one disease—emphysema. When the vesicles are very large, and grate against the anterior surface of the chest, they sometimes produce a friction in inspiration and expiration. The sound is a dry one, and receives the name of subcrepitant because it is more nearly like that rhonchus than any other.

The mucous, subcrepitant, sonorous, and sibilant rhonchi, are sometimes heard combined together in a variety of chronic catarrh, attended with asthmatic paroxysms; they were then sometimes called by Laennec the song of all birds—"cantus omnium avium." More frequently, however, we may find two at least of these rhonchi present at the same time, as the sonorous and sibilant, the mucous and the subcrepitant; a dry may be combined with a moist rhonchus. This depends upon an obvious cause; the various portions of the mucous membrane may be affected to different degrees, and in one part secretion may have commenced,

while another remains turgid and dry; besides, the secretions tend to accumulate at the posterior and inferior part of the lungs; hence we find the moist rhonchi sometimes in this position, when the same inflammation gives rise merely to a dry rhonchus elsewhere.

The rhonchi may also be connected with other physical signs, as the bronchial respiration and resonance of the voice, and it is often a matter of some difficulty to distinguish them. This is especially the case with the bronchial respiration and the sonorous rhonchus; one not accustomed to these signs may easily mistake one for the other when they occur singly, and if combined, the sonorous rhonchus may mask the bronchial respiration to an inexperienced observer; for these signs are both heard during their expiration, and there is a certain degree of similarity between them. The only certain distinguishing mark when there is a difficulty, is to examine the part of the chest by percussion; if this be flat it will prove that there is bronchial respiration wherever the tubes are large; if both bronchial respiration and sonorous rhonchus are present at the same time, the flat percussion is so far useful that it indicates the more important sign. The chances of error, therefore, become extremely small, and are still more diminished if we attend to the musical tone which attends the sonorous rhonchus; this does not characterize the bronchial respiration, which is a pure blowing sound.

After having gone through the description of these sounds, the reader may be tempted to make the same remark which has often been repeated to me. That is, that the difficulty is not in understanding the description of the sounds, but in acquiring the habit of rapidly and readily recognizing them. To be practically useful we must distinguish them with certainty, and should do this without great loss of time to ourselves, or the fatigue to our patient which necessarily results from a protracted examination. If an inexperienced physician should be tempted to lay too much stress upon his newly-acquired knowledge, he may perhaps be induced to fall into the errors against which I have warned the reader at the beginning of this treatise—that is, of trusting too much to physical diagnosis.

Now we must avoid both these errors; and we do this by the same means—that is, by making our diagnosis by the general symptoms, and merely adding the physical examination to this as a matter of instruction, until we are sure of our own progress. The caution is designed for those who trust chiefly to their unaided exertions; these are, under ordinary circumstances, sufficient, though necessarily attended with more trouble, and requiring more time. I shall bear these remarks in mind when describing individual diseases, and will group the physical and general signs together, that one may mutually assist the other.

The rhonchi, as well as the other sounds of the lungs, are heard without difficulty in most cases; but sometimes when the lungs are not much diseased, or when the bronchial tubes are partially obstructed, it is necessary for the patient to breathe with a certain effort. It is right, therefore, if we are not perfectly satisfied with the auscultation of the respiration, to tell the patient to breathe quickly, so that the air may be driven rather forcibly into the vesicles, and the sounds may thus be well developed.

There is another set of symptoms which are not physical, yet are so local in their character that they should be described before you proceed to the study of special diseases; these are the cough and expectoration, which may properly form the subject of another chapter.

SPIROMETRY.

A new method of measuring the chest, by determining the permeability of the lungs to the air, has lately been introduced to the profession by Dr. Hutchinson. The instrument used for this purpose is termed a spirometer. This instrument has been since modified by Dr. Pereira, who has simplified very much the method originally proposed by Dr. Hutchinson. It is a large cylinder, generally made of metal, suspended by a cord in a vessel filled with water; the cord passes over a pulley, and has a weight attached to it to balance the cylinder in any position. "A pipe,

forming the continuation of the tube through which the patient has to breathe, rises in the bell-glass close to the level of the water; and by forcing the air through this tube the vessel will ascend and indicate, by a graduated scale affixed, the quantity of air passed into it."

It was found by Dr. Hutchinson that the vital capacity of the chest, or the quantity of air which passes into and out of the chest, was modified by four circumstances: 1. By the height of the individual; 2. Age; 3. Weight; 4. Disease. Singularly enough, the height of a person has a very great influence in determining his vital capacity. This is independent of the size of the chest; for even if tall men have small chests, or short men have large ones, their vital capacity is proportioned to their weight, and not to the size of their chests. Tall persons always have a much greater vital capacity than those of shorter stature; that is, it is intimately connected with the height of the patient, and not with the development of the chest. This result seems very singular, and not in accordance with our ordinary views upon the subject.

The weight and the age of an individual have also considerable influence in modifying the quantity of air inhaled. Any great addition to the ordinary weight will cause him to inhale a less quantity of air; but a slight increase of size will not modify the quantity inspired. The age modifies the power of inspiration, which is at a maximum between the ages of thirty and thirty-five—diminishing afterwards.

Disease is a more important cause of variation. In cases of pulmonary phthisis just commencing, Dr. Hutchinson believes that he can often detect the presence of the disorder by the fact that the vital capacity of the patient is diminished before any other physical signs of the disorder exist. Dr. Davis, from whose lectures I have drawn this notice of Dr. Hutchinson's memoir, agrees in the statement put forward by the latter gentleman. It seems to me, however, to be more than doubtful if an examination of the vital capacity of the chest could do more, in any case, than simply confirm the conclusions to which we would be led by an examination of the general symptoms of the

patient. Besides, this method certainly would not be able to give us any idea of the various causes, as diseases of the heart or different affections of the lungs, which might alter the vital capacity of the chest.

This method of examination is of very little practical service in the examination of diseases of the chest. It has, however, some value as indicating the quantity of air that may be inhaled in cases of health or disease, but of course it is much inferior to the methods of investigation which are applied directly to the chest.

CHAPTER V.

COUGH—EXPECTORATION—MOVEMENT OF THE THORAX.

COUGH is produced in diseases of the thorax from two causes—the accumulation of liquid in the bronchial tubes, and the sympathetic irritation caused in the larynx by pain or stricture in the chest. In the former variety the cough is useful, and is productive of relief to the patient: in the latter it is often a cause of aggravation of the symptoms. The true excretory cough occurs only in the diseases of the bronchial mucous membrane and of the parenchyma of the lungs which directly communicates with this membrane. The other variety of cough may be called irritative, and takes place not only in the earlier stages of inflammation of the bronchial tubes and of disorders of the parenchyma and serous membranes which do not communicate with the bronchi, but it is also a frequent dependent upon diseases of the heart, and even of the stomach, and in many cases is caused by disordered condition of the nervous system, which is totally foreign to the chest. It is evident, therefore, that the causes of the irritative cough are extremely various, and that the cough itself, in many cases, throws but little light upon them.

I shall now attempt to define the varieties of cough and of the expectoration, which are closely connected together.

The dry or irritative cough. The term irritative may properly enough be applied to this variety, which is nothing but a short and quick cough; that is, a short and rapid expiration, which is the essential character of cough. The term dry cough is so well known as the designation of this variety, that it is universally understood. It is followed by no real secretion; there is sometimes an expectoration of the small quantity of mucus which is naturally found in the fauces and bronchi. The diseases of the

lungs in which it occurs are the early stages of phthisis and certain cases of serous inflammation. It is also an attendant upon the elongation and inflammation of the uvula, and may cease abruptly after its removal. In diseases of the stomach and bowels, and in affections of the mucous membranes of the abdomen as well as in peritonitis, an analogous variety of cough is observed. Indeed, we may generalize the subject much further, and say that the short, dry cough is the most frequent form of irritative cough, and the most persistent; and that, although in itself it is of no moment, it is often the sign of a commencing disease of the thorax. On the other hand, our knowledge of the circumstances which give rise to a dry cough, must lead us to look for other causes of it than the diseases of the chest; and after our physical examination has taught us that there is no important lesion in the thorax, the next object will be to examine other portions of the body, and ascertain whether some disease of the abdominal viscera, or a mere nervous irritability, will not account for this cough.

Sonorous cough. There is another variety of cough which is not very unlike the dry—that is, the sonorous cough; this is always loud, and at times very ringing and clear, so as to be heard at a considerable distance from the patient. This variety belongs to many morbid conditions; it is found in the chronic dry catarrh, but chiefly in the earlier stages of ordinary acute catarrh before secretion has commenced. In its most marked degree, however, the sonorous cough is not indicative of diseases of the lungs, but of many and various conditions of this morbid nervous action; and, as may readily be supposed, it is most apt to occur in young girls, who are much more subject than any other class of individuals to diseases attended with deranged nervous action. Hence the cough is very irregular in its indication; and although, when it is of recent occurrence and short duration, it is nearly always connected with disorder of the bronchial tubes, yet, when chronic, it is most frequently either a true nervous cough, or an attendant upon chronic diseases of the larynx, especially those in which there is a morbid growth which projects into the rima glottidis, and acts as a constant cause of irritation. This cough is therefore rather a

matter which must exercise the sagacity of the physician, than a correct indication of any special disease.

The *suppressed cough* is, like the dry, a short cough; but it is checked by a voluntary effort of the patient; for as the act of coughing is, to a certain extent, independent of the will, a patient may arrest the violent expiration if he be aware that it will cause him much pain; hence the cough becomes suppressed in serous inflammations of the chest, where there is little or no secretion from the bronchi, and the pain is much more considerable than in ordinary cases of disease. In pertussis, the fear of exciting a violent fit of coughing will frequently cause it to be suppressed. In the early stages of pneumonia there is very little secretion into the bronchi; hence the necessity for cough and expectoration is but slight, while the accompanying pleuritic inflammation acts as in cases of simple pleurisy, and suppresses the cough.

The *laryngeal cough* is various in its character; still, as it depends upon thickening or ulceration of the larynx, the tone of the cough is stridulous and somewhat stifled—at times almost whistling. In the advanced ulceration of the larynx, which constitutes laryngeal phthisis, the cough is alternately loud and whistling, and again almost aphonic. This variety of the cough is attended with a peculiar alteration of the voice.

The *loose* or *mucous cough* is well known as the cough which attends the resolution of acute bronchitis, and is therefore of favorable prognosis in this disease; it is connected with a free secretion into the bronchial tubes, and is of course accompanied by mucous rhonchus, and generally by expectoration. As there are many diseases in which there is an abundant liquid secretion into the bronchial tubes, the mucous cough is very far from being confined to bronchitis; it occurs also in the advanced stages of phthisis, in the third stage of pneumonia, hæmoptysis, etc. Hence, like most of the varieties of cough, it becomes useful as a sign, chiefly when combined with other symptoms.

In certain cases of large cavities from phthisis or gangrene, the cough differs from ordinary varieties of mucous, by its being loud and rattling; that is, as it is caused by the free agitation of the air in a large cavity, it partakes of the characters of the cavern-

ous respiration, and differs in being much louder and more gurgling from the ordinary mucous cough.

In certain cases of bronchitis, the cough becomes very loud and mucous—that is, where a large secretion takes place into the lungs. An analogous character of cough exists also in hæmoptysis as well as in consumption; in the former disease it is produced by the presence of blood in the large tubes, and in the other by the softening tuberculous matter and mucus.

The *spasmodic cough* is the last variety of cough which is sufficiently characterized to admit of a separate description. The type of this variety is found in pertussis, in which disease the cough is more decidedly spasmodic than in any other. But there are numerous other cases of disease, especially lesions situated about the larynx, which are attended with a severe cough, returning in paroxysms, and sometimes accompanied with a noisy, hooping inspiration. Although it is most frequent in obstructions about the larynx and upper part of the trachea, the enlargement of the bronchial glands will often give rise to it, and the peculiar cough is sometimes a valuable diagnostic sign in an affection which is always obscure. In certain cases of asthma the cough recurs in paroxysms which are often attended with a noisy inspiration.

In general terms, we may state, cough does not bear an accurate relation to the extent of the pulmonary lesion; frequently the cough seems to be almost in inverse proportion to the mass of parenchyma involved in the disease. For if a large portion of the lungs be rendered unfit for the performance of the respiration, the patient cannot make the forcible expiration necessary to produce a decided cough. It is often rather a sign of laryngeal and tracheal irritation, than of deep-seated pulmonary disorder. The cough is of less value as a sign in the aged than in those enfeebled by disease, or than in other patients, for in them it may be wanting throughout the whole course of a grave disorder: the same remark is applicable to young children, who cough much less frequently than those who are older.

In diseases of the lungs in general, the cough may completely cease if the brain becomes seriously involved; for a cerebral disorder renders a patient unconscious of the irritation, which, under ordinary circumstances, would give rise to severe cough. Second-

ary inflammation of other organs, as the stomach and bowels, sometimes produces a similar effect, but to a much less degree; this is in accordance with the general pathological law, that a severe intercurrent inflammation will obscure, and to some extent replace, the symptoms of the primitive affection.

The cough furnishes us also a good means of testing whether the lung is capable of admitting the air. The act of coughing, while the ear is applied to the chest of the patient, dislodges the secretions in the small bronchial tubes and cavities of the lung, and thus brings into strong relief many of the rhonchi, as crepitant and subcrepitant, which before were not distinct. We therefore often, at the end of the second stage of pneumonia, direct the patient to cough, and we are sure of finding a most abundant train of crepitant rhonchus, which follows the cough and accompanies the quick inspiration which is produced by the quick expirations which constitute the act of coughing. In the same way in cases of phthisis in which cavities exist at the summit of the lungs, but are for the moment rendered indistinct from the difficulty with which the air enters into them, we find that they are cleared out by a strong effort of coughing, which suddenly expels their contents and then renders them distinct.

THE EXPECTORATION.

The expectoration is a less frequent symptom in diseases of the chest than the cough; but its signification is more definite, and in some cases affords very accurate indications of pulmonary disease. As a general rule, the sputa come from the lining membrane of the bronchial tubes, or from the larynx and trachea, and from cavities or softened portions of the parenchyma, which communicate directly with the bronchi. Hence their value as positive signs is chiefly confined to the diseases which affect the mucous membranes of the chest, or in some way interfere with the integrity of the tissue of the lung. The sputa, however, may contain other liquids besides the ordinary secretions of the mucous membranes, such as blood, and tuberculous and calcareous matters.

The secretion of liquids in the bronchi is necessarily independent of the will, but the expectoration is, for the most part, a

voluntary act. It is performed imperfectly when a person is averse to making the necessary muscular exertion, on account of the pain it may give him, or other reasons; there are no sputa when the feebleness or the insensibility of the patient prevents his making an effort. For similar reasons, children below the age of six years do not expectorate; they do so but rarely until the age of puberty. In very old people the expectoration is rare, and not proportioned to the extent of the disease.

When the sputa are not copious, they are chiefly expectorated in the morning, on waking from sleep, during which they accumulate in the bronchi. When the sputa are copious, but the expectoration causes pain, they are also retained in the lungs until a paroxysm of coughing comes on, and they are discharged in large quantities.

Except in the cases above mentioned, the sputa are rarely wanting during the whole course of a disease, but they do not usually assume their characteristic appearance until the disease is sufficiently advanced to be recognized by the more certain physical signs. In some exceptional cases the sputa are pathognomonic, when the physical signs are doubtful, on account of the remote situation of the lesion or the state of the surrounding tissue.

1. *Of the quantity of the expectoration.* It is small when it does not exceed a wineglassful in the twenty-four hours; moderate, when from two to six fluid ounces; large, from six ounces to a pint; and very large, if more than a pint. In descriptions of the sputa, it is advisable to state the quantity.

2. *Of the color.* The saliva and the mucus of the bronchial tubes are transparent, or nearly so, and may be more abundant than usual. A higher, or rather more prolonged degree of inflammation of the bronchial mucous membrane, gives a whitish color to the sputa, if the catarrh pass into resolution; or, if it assume a chronic form, the sputa are yellowish, and frequently of a greenish tinge, and altogether opake. In acute inflammation of the air-vesicles and of the minute bronchial tubes, the sputa are at first transparent and colorless, but soon become tinged of an orange hue, or they are rust colored, or even sometimes of a bright-scarlet color. In inflammations of the lungs, with great

prostration, the sputa are brownish, of a mahogany color, or like that of stewed prunes.

In pulmonary phthisis, the sputa are in part of a whitish, creamy appearance, and in part consist of a thin mucous, or muco-serous liquid; at other times they are reddish, sometimes thickened with blood, and occasionally are of a bluish or almost black hue. In the advanced stages of phthisis, the yellowish color predominates, giving them sometimes a general yellow hue, more marked, however, in the nummular masses than in the adjoining sputa; finally, in the last stages of phthisis the color is usually yellow or grayish yellow, when the sputa are nearly homogeneous in consistence. In pleurisy and other inflammations of the serous membrane of the chest the sputa are comparatively rare, and are usually quite transparent.

3. *Consistence and chemical composition.* In general, the sputa, if colorless, are thin and very liquid; those that are yellow and opake, are thick, and flow less easily. The shining transparent sputa of pneumonia, though small in quantity, are more viscid than any other, are often heaped up in the center of the cup, and adhere strongly to its sides. In one variety of chronic catarrh, and in some affections of the tonsils, the matter expectorated is very small in quantity, and almost solid.

Sometimes in very chronic catarrh the sputa are very thick, of a pale-pearly hue, and molded to each bronchial tube, so as to look almost like earth-worms. In phthisis the consistence of the expectoration is usually at first very slight, like that of acute bronchitis. But in the more advanced stages, the sputa become firmer, especially the nummular portions; in the last stages, the consistence is not viscid, but the sputa are moderately thick.

In gangrene of the lungs the sputa are generally of a dull-white color, but sometimes they have a yellowish tinge. They also vary very much in their consistence. They are usually thin, and scarcely more viscid than water at first; but afterwards, they form thicker masses, sometimes consisting in part of semi-coagulated blood, and in part of pus coming from the surface of the bronchial cavity, from which the gangrenous masses have been discharged.

The sputa frequently consist of two parts—one more solid, and the other nearly of the consistence of water. If much air be mingled with the sputa, they are light and frothy. The chemical nature of ordinary bronchitic sputa scarcely differs from that of the healthy mucus of the bronchial tubes, but if the inflammation be more advanced, the sputa are more opake, and become more albuminous. The increasing thickness of the sputa is a sign of a tendency to resolution in acute bronchitis, which is but slightly influenced by the mucous expectoration of its earlier stages. When pus is mixed with the mucus, the consistence is immediately increased; the thick, pasty sputa which occur in advanced stages of phthisis, in which the softening is very rapid, are very consistent, and of a dirty, grayish-yellow color, but adhere together less intimately than the sputa of pneumonia.

4. *Form.* When the sputa are composed of simple mucus from the bronchial tubes, they run together and form a mass which is perfectly homogeneous. When they become albuminous, they offer no peculiar form, but are generally composed of two parts—one consisting of the whitish-opake mucus, which, in the form of shreds is diffused through the mass of the liquid, and the other more transparent. In some cases of bronchitis, especially of the chronic varieties, in which the sputa are more albuminous than in any other, the matter is molded into the form of the smaller bronchi, and is expectorated in little cylinders, which are diffused through the secretions of the larger tubes. The viscid, transparent sputa of pneumonia blend together perfectly well, and form a mass which is often with difficulty separated into smaller parts; and the sputa, both of the early and latter stages of this disease, are so nearly similar to those of different stages of bronchitis, that they can scarcely be distinguished from them. The form assumed by the expectoration of phthisis is similar to that of bronchitis in its early stages; after softening has been completed the sputa are molded in the cavities, and form irregular, rounded masses, with loose cottony edges; these constitute the nummular sputa. When the softening is very rapid, the sputa run together and lose their nummular form. They are thus accumulated in homogeneous masses, which are sometimes very copious. The sputa in gangrene of the lungs retain no peculiar form, but vary

according to the consistence of the matter in different cases of the disease.

5. *Odor.* Transparent sputa are without decided odor; the thick, yellow liquid has generally a faint, nauseous smell, which is very marked in cases of phthisis. Gangrene of the lungs is distinguished by a peculiar fetor, sometimes gangrenous, at other times resembling the smell of moist plaster. Occasionally, a variety of chronic catarrh and one of tuberculous phthisis, in its advanced stage, are attended with fetid expectorations.

Of the foreign matters mingled with the secretions of the bronchial tubes. Pus is often intermixed with the mucus secreted in bronchitis, phthisis, and the latter stages of pneumonia, when the sputa are said to be muco-purulent. Sometimes a portion of the pus is uncombined, and sinks to the bottom of the mass. In some rare cases the expectoration consists almost purely of pus, not very different from that of an abscess. This is most common in some varieties of bronchitis.

Blood may be intimately combined with the sputa, as it is in pneumonia, when it communicates a general rusty or reddish tinge to them; or it may be mixed in streaks with the mucus, and still retain its florid-red color; or, lastly, it may be unmixed with the bronchial secretions, when it constitutes hæmoptysis.

Sometimes even in bronchitis there may be a small admixture of blood with the sputa, forming merely streaks running through the mass of expectoration. When the blood is sufficiently abundant to constitute hæmoptysis, it is in most cases a sign of tuberculous disease. But to this there are numerous exceptions; the estimate of Andral seems very nearly correct; five cases out of six of hæmoptysis in males are connected with consumption, and two cases out of three have the same connection in women. The other cases result in women chiefly from disorders of the menstrual function, and in males from disease of the heart.

The tuberculous matter may sometimes, though rarely, be detected in the sputa, under the form of minute yellowish opake grains, not often exceeding the size of a pin's head; this appearance coincides with the softening of the tubercles. In a few cases it is sometimes found in distinct masses. Calcareous matter is sometimes, though rarely, observed when the tubercles are

dry and contain much of the salts of lime. Portions of gray or dark pulmonary tissue have also been expectorated after separation from the adjacent tissue.

In cases of jaundice or pneumonia, complicated with disease of the liver, the sputa are sometimes tinged with bile. I have seen the expectoration composed almost entirely of pure bile, from a fistulous opening between the liver and the lungs, following a wound of these organs.

I have confined these remarks on the expectoration chiefly to the text of the earlier edition of this work on physical diagnosis which I published more than twenty years since. They might be much extended, but as the subject is one to which I shall be obliged frequently to recur when speaking of individual diseases, I do not wish to annoy the reader with unnecessary repetitions. Still it is essential for us to acquire some idea of the general characters of the expectoration. The best method of examining the sputa is to direct the patient to spit in a white or transparent vessel—a common tumbler will do well enough for this purpose—and then inspect them within a few minutes after they are discharged.

The chemical analysis of the sputa has thus far led to few or no practical results, for the characteristic distinctions between the various forms of mucus, albumen, and pus are extremely slight. Indeed, it is not necessary for us to investigate, or rather to attempt to investigate, these slighter differences in the expectoration, which were at one time regarded as important. Among these are the numerous tests between pus and mucus, which were sought in order to decide upon the distinctive characters of phthisis and catarrh; all these were found more or less fallacious. The best are the most simple—that is, the yellow, purulent color of the expectoration when pus is mixed with the mucus, for it is rarely found in a separate state. This very admixture is one of the reasons which must make it impossible to discriminate, in all cases, as to the mucous or purulent character of the expectoration. The whole subject is now placed in its proper light; the expectoration furnishes us with a most valuable secondary means of diagnosis, but one less important than

many other methods of investigation that have now come into general use.

There is another class of symptoms which may be almost classed among the local signs of thoracic diseases—that is, the mode in which the movement of the chest is performed during the act of respiration.

ON THE MOVEMENT OF THE THORAX.

In health, the act of inspiration is performed partly by the elevation of the shoulders and ribs and partly by the depression of the diaphragm. The passage of the air through the nostrils does not cause them to dilate evidently. When the respiration becomes difficult, the different muscles whose action concurs in respiration act irregularly and much more forcibly than in a state of health.

When there is much dyspnœa, without pain in any part of the thorax, all the muscles concerned in respiration act with increased energy. The nostrils dilate widely, the shoulders and ribs are forcibly elevated, and the diaphragm depressed. In acute diseases, the degree of the dyspnœa is nearly commensurate with the extent of the pulmonary affection. In chronic diseases, this is by no means the case; the patient, becoming to a certain extent habituated to the difficulty of respiration, can often exist while a very small portion of the lungs is capable of acting, and still the difficulty of breathing may be slight. There are even some instances in which there is extreme dyspnœa, but no appreciable lesion of the lungs.

When there is acute pain in the sides of the thorax, or at the diaphragm, from inflammation of the serous membranes, the parts of the chest nearest to the inflamed pleura move less than they do in a state of health. The motion becomes free as soon as the pain subsides. If effusion of liquid occur into the pleura or the pericardium, the motion of the ribs at the corresponding part is impeded by the mechanical distention, though there may be no acute pain. When the liquid is absorbed, and false membranes unite the two surfaces of the pleura, the dilatation of the diseased side is always imperfect, and remains so if the contraction is very

great. The diminished motion of the side of the chest most affected in phthisis depends upon the adhesions produced by the frequent inflammations of the pleura.

The number of the inspirations in adults is generally from twelve to sixteen in the minute, when they are in a recumbent position—in some persons they may be a little more frequent, as many as twenty; but when the lungs or the pleura are much inflamed, the inspirations may increase to thirty or forty; and when the disease is extremely violent, the number may be as high as sixty or seventy. In young children they are sometimes even still more rapid. The extreme frequency of the respiration in adults is most remarkable when all the serous membranes of the chest are inflamed at the same time. In acute diseases of the chest, the number of the inspirations is at first nearly proportional to the violence of the affections; when they have lasted a certain time the patient seems to accommodate himself to a diminished supply of air, and breathes less often. The respiration of children affected with diseases of the chest is very frequent, especially when the lobular pneumonia has extended to a large portion of both lungs. In the state of health even they breathe more often than the adult. When the rapidity of the respiration in acute diseases has ceased, the inspiration remains more hurried than usual; sometimes it is performed in as short a time as the expiration, after which a pause ensues. In health, the time required for the inspiration is about twice as long as that of the expiration, both in children and adults.

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CHAPTER VI.

PLEURISY—PATHOLOGICAL ANATOMY—PHYSICAL SIGNS—SYMPTOMS—DIAGNOSIS—TREATMENT.

PLEURISY, as is well known, is an inflammation of the serous membrane involving the lungs; it is very regular in its progress and symptoms. Like the other inflammations of this tissue, it is sometimes simple and readily diagnosticated, and at other times is singularly complex, or perhaps consecutive to other disorders of a different and more constitutional character. For example, it may be connected with tuberculous diseases in several ways: first, turbercle may be developed in the adherent and more cellular portion of the serous membrane, and the inflammation may directly coincide with this development; in these cases the tuberculous deposit is formed, as it were, by the same process as the inflammation, and apparently by the same action of the vessels. In other cases the pleurisy is consecutive to the tubercles already deposited in the lungs. In a third variety the pleurisy may attack an individual in good health, and afterwards give rise to the tuberculous deposit, partly from the general shock given to the constitution, and partly from the determination of the diseased action toward the lungs. This latter variety usually occurs in persons of a tuberculous tendency; but it may prove a purely accidental cause of tubercles, and take place in those whose constitution is not previously tainted by this diathesis. Pleurisy also occurs in a more acute form as a complication of affections of the parenchyma of the lungs, when they approach the surface of the organ invested by the pleura. Pneumonia is the disease of the lungs which most frequently gives rise to this variety. There are some other lesions producing the same effect, which are, however, of rare occurrence, viz., gangrene and scir-

rhus; when these approach the surface of the lung, they cause inflammation of the serous membrane, with an effusion of lymph, this inflammation being in almost all cases preservative, as the adhesion which takes place prevents an effusion of the morbid matter into the cavity of the pleura.

We have, then, three principal varieties of pleurisy: first, simple pleurisy; secondly, pleurisy complicated with a deposition of tubercular matter; thirdly, pleurisy complicated with acute lesion of the parenchyma of the lungs.

The pathological changes connected with ordinary pleurisy are regular in their progress, and proceed, step by step, with the symptoms, which afford us a means of measuring the intensity of the inflammation.

The first change which takes place is the injection of the membrane, caused by an enlargement of its vessels, which, in the natural state, do not transmit the red globules of the blood. These vessels are situated in the subjacent cellular tissue, and are disposed in an immense number of branches, which are interlocked in various directions, and form a complete net-work. In the midst of this there are numerous bright-red points, apparently formed by minute extravasations of blood from the vessels.

Almost simultaneous with this increase of vascularity is the development and effusion of lymph. This is at first deposited on the serous surface in minute points, which are transparent and scarcely visible, but may be readily detected by the touch. These points, as they become more numerous, gradually collect into groups, which, finally coalescing, become a continuous membrane. This deposit of lymph has received the name of a false membrane, and is more abundant at the lower portions, where it is in some cases as much as a fourth or even half of an inch in thickness, while at the upper portion it seldom exceeds an eighth of an inch. The character and amount of the effusion vary according to the variety of the disease, and the constitution of the individual affected. In cases of local pleurisy, especially if occurring in robust persons, the amount of serum effused is very small, while there is a considerable deposit of lymph; the same also occurs in persons who are not robust when the inflammation is confined to a small portion of the membrane. On the contrary, if the patient be thin,

and of a lymphatic temperament, and the inflammation diffused, the effusion of serum will be very great, with but a slight trace of lymph. The thin and serous part of the effusion tends to diffuse itself over the surface of the pleura, gravitating to the most dependent portion, and shifting its position with the movement of the patient. When, however, it is principally composed of lymph, it is confined to the part of the lung which is affected, and exhibits no such tendency to change its place of deposit.

The serum increases in quantity as the disease advances, and decreases with its decline; but the lymph is more persistent, and, instead of being removed, becomes organized, and assumes the character of a serous or cellular membrane, according to the circumstances in which it is placed. When the inflammation continues for a considerable length of time a secretion of pus takes place, and after a time the serum may be entirely replaced by purulent matter. The lymph in this case being bathed in pus is modified in color, assuming a yellowish hue. When the serum is abundant the lower portion of it is quite turbid, while the upper portion is comparatively clear. This results from the greater specific gravity of the lymph, in consequence of which it settles to the bottom of the fluid, which thus assumes a dull-white or yellowish color. When this effusion is great, the walls of the chest are actually dilated by it.

The proportion of the lymph or serum varies according to the character of the individual and the type of the pleurisy. Thus, if the patient be very meager or of a lymphatic temperament, the secretion will consist almost exclusively of serum, a mere trace only of lymph being met with. In fact, these are cases of pleurisy which differ very little from those of hydrothorax, although the liquid is effused in consequence of true inflammation.

In other cases the matter effused consists almost exclusively of lymph, thus constituting what is termed *dry* pleurisy. In the latter class of cases the disease is apt to end very quickly in recovery.

During the recovery of the patient, the following changes are observed to take place: as the serum is absorbed, the pressure of the atmosphere forces the parietes of the chest toward the lung, and adhesion takes place between the two surfaces of

the pleura. As the lung is compressed against the spine, and in that position is covered with a coating of lymph, it often remains permanently flattened, so that it cannot perfectly rise to meet the ribs. In those cases in which the pleurisy is moderate, and the effusion very small, there is either no contraction of the chest, or it takes place to a very slight degree. When the contraction is not entirely permanent, the lung, after being compressed, does again expand to a certain extent, and rises partially toward its original form.

When the pleurisy is but moderate, and the effusion of lymph and serum is of course small, the dilatation of the chest is not very great during the height of the inflammation. When the disease has ended in recovery, there can of course be no perceptible contraction. When the effusion is larger, however, there is always considerable dilatation during the period of effusion; and after recovery, there always remains a very decided contraction of the chest. But this contraction is not equable; it is usually most apparent at the lower and posterior part of the chest, for there the effusion has been greatest during the early stage of the disorder. In cases, however, in which the pleurisy has been more severe, the contraction is very decided over the whole chest, and is quite as perceptible in front, near the clavicles, as at the posterior portion. Besides this, the intercostal spaces are depressed, and the chest on the affected side remains nearly as immovable after recovery as in the early stage of the effusion.

The adhesions become gradually organized during this process, and new vessels appear in the lymph. The particles of blood are deposited in the lymph, scattered in dots, and gradually collect in trains or streaks; vessels are afterwards formed around the blood, which then finally inosculate with the original vessels of the subjacent serous tissue. The contraction of the chest is not great when the serum is but moderate in quantity; but in cases of abundant effusion, the contraction is almost equally well marked with the previous distention. The alteration of conformation, therefore, is a purely pathological state, which corresponds accurately with the quantity of liquid exhaled. If the effusion be limited, it does not produce a very decided dilatation or sub-

sequent contraction: a less quantity than a pint is scarcely appreciable; a quart gives rise to a very decided alteration in the shape of the chest, and larger quantities distend it sufficiently to incline the body toward the sound side. In the same way, if the contraction which follows pleurisy be very great, the whole body is sometimes inclined toward the diseased side.

The nature of the liquid is not always the same; the greatest portion of it consists of serum in the early or inflammatory conditions of the disease. This is mingled with flocculi of lymph of various density, which seem to be detached from the surface of the pleura. In the chronic varieties of the disease, the liquid consists almost exclusively of purulent matter, although at first the serum is merely tinged with pus from a small admixture of pus-globules with it; but as the disease continues longer and becomes chronic, the purulent globules become gradually more and more abundant, until the liquid consists nearly of pure pus; the pleurisy is then often called empyema. It is in these cases that the distention of the chest is greatest. In the early stages of some cases, pus is mixed with the serum and lymph in small quantity, giving the liquid a slightly yellowish tinge; as a general rule, it is almost quite transparent but turbid, and of a light greenish-yellow color. In a few instances it coagulates spontaneously immediately after death, becoming a mass of tolerably dense albumen. In a number of cases it contains blood in small quantities, and occasionally, although rarely, the proportion of blood is large. These varieties in the exhaled fluid belong to the same disorder, which is in all these cases inflammatory; but the product varies according to the general condition of the individual's previous health, and other circumstances difficult to discover. In general, the product of inflammation of the pleura and other serous membranes is most consistent and most highly animalized when the patient is strongest, and the disease most violent.

Physical signs. The pathological changes I have just described are very regular, and give rise to an equally regular succession in the physical signs. When the inflammation is severe, and the effusions very large, these signs are pathognomonic of the disease; but when it is small, the physical characters are so far useful, that they either confirm the indications of the functional signs, or prove

that the disease is not advanced beyond a certain point. When the effusion of serum takes place, the sound on percussion is immediately dull, becoming gradually flat as the quantity of the liquid increases. The flatness is much more decided at the lower than at the upper portion of the chest, and becomes gradually less in ascending toward the summit; for the liquid of course gravitates toward the most depending portions. Still, the serous effusion is not the only cause of the flatness; it depends, in part, upon the thick deposits of lymph at the inferior portion of the lungs, and does not disappear entirely when the position of the patient is changed, although a change in the level of the liquid is always attended by a change in the degree of flatness. If the effusion be very large, the flatness gradually becomes more complete, and at the same time extends over the side of the chest, until the resonance is either lost, or is limited to a small portion of the chest near the spine, where the large tubes, and even a small portion of the lung, generally contain a little air.

The increase in the flatness enables us to estimate the extent of the effusion with great accuracy; but the converse of this is not true in its declining stage, for when the compression of the lung is carried to a great extent, it recovers its elasticity but slowly, and remains either permanently or for a long period in a more solid state than is natural; hence the clear sound returns slowly, and often never recovers its original sonorousness. A moderate but diffused resonance does not, therefore, prove that the lung has not recovered from the inflammation: it merely shows that the lung remains a little compressed, either from the adhesion which follows the inflammation or from lymph which is not yet absorded.

It is said by some authors, and especially by Skoda, that in cases of pleurisy with moderate effusion, there is really an increased sonorousness at the upper part of the chest, at the point where the liquid does not reach. Sometimes it is true that by a careful examination the percussion here yields a sound which seems to be a little clearer than that afforded by a healthy lung at the same spot. The cause of this increase of sonorousness may, however, be readily explained. It is not rendered more perceptible in consequence of any change in the part of the lung

over which percussion is made, but the tap resounds more strongly simply in consequence of the partial consolidation of the portion of the lung compressed by the pleuritic effusion. Thus we are not striking merely over a healthy lung, but over one which is distended with air, in consequence of a larger portion being driven into it than there would be in the healthy state, so that the percussion would of itself be sonorous; but the resonance is increased in consequence of the reverberation from the adjoining mass of liquid and half-compressed lung.

The percussion on the opposite side of the chest, both sides being very rarely affected in cases of pleurisy, is rather clearer than the average of healthy lungs. The healthy lung being distended with air, is obliged to work with more energy than in the state of health; hence a larger portion of air rushes into it, and the sound is therefore preternaturally clear. This of course gives us greater facilities for estimating the dull sound on the affected side.

The enlargement of the affected side accords with the dullness on percussion, and is always met with when the dull sound is at all decided. If, in the early stages of the pleurisy, we examine the lower and posterior parts of the chest, we may readily detect slight changes in the conformation; and this is then generally limited to an alteration of the natural convexity of the thorax, and is scarcely perceptible in the whole semi-circumference. The quantity of liquid which is sufficient to cause a decided change in the conformation varies from a pint to more than a gallon. When it exceeds a gallon, the distention is of course very great. I have, on one occasion, in which the bulging of the affected side was immense, found a quantity which I estimated at not less than two gallons in the right pleura. In these extreme cases the healthy lung is compressed toward the ribs of the opposite side, at the same time that the diseased one is forced against the spine, and death may sometimes occur from suffocation. The semi-circumference of the chest may be measured with a tape on a level with the sixth or seventh dorsal vertebra, or with a pair of callipers, in order to give us an idea of the changes which take place in the quantity of the liquid; but this method is of little use except in cases in which the effusion is very large. And

it must be always remembered that the right side is naturally larger than the left; if we do not attend to this fact our conclusions may be very erroneous. The position of the heart is another sign which is closely connected with the alteration in the conformation. If the pleurisy occur on the left side, the heart is sometimes forced to the right of the sternum; if, as is most frequent, the pleurisy attack the right side, the heart is removed toward the left axilla.

The respiration in the early stages of pleurisy is always feeble at the lower part of the affected side; that is, if either the pain is tolerably acute, or the effusion at all considerable. But at the beginning the feebleness depends much more upon the pain which prevents a full inspiration than the mechanical pressure of an effusion which is still quite small in quantity. When the dilatation of the vesicles in a part of the chest is attended with pain, that portion of the lung becomes to a great degree motionless, and remains so until the pain diminishes. This rule is so general in its application, that if the serous membranes of the chest be inflamed to a great extent, and over both lungs, the patient may perish from the dyspnœa which arises from the inactivity of so large a portion of the pulmonary tissue.

The comparative immobility of the side of the chest affected with pleurisy is sometimes very remarkable, the patient raising up the unaffected side, while that attacked with the inflammation remains almost quiet. The free movement of the chest never returns on the affected side during the course of the disorder; and if the effusion of lymph or of serum has been considerable, the lung becomes so closely bound to the ribs that even after complete recovery it may be distinctly seen that the side of the chest which has been affected dilates less strongly than the opposite one. This moderate movement of the chest cannot be accounted for by the pain, for sometimes it occurs when the patient is perfectly or nearly free from any severe pain in the act of respiration. It depends, in part at least, upon the compression of the lung, and the known fact that all inflamed tissues tend to become quiet, or at least their action is somewhat interfered with.

The feebleness of the respiration continues throughout the disease in those portions of the lungs in which the bronchial tubes

are small; where they are much larger the respiration becomes more or less bronchial, or at least rude. The intensity of the rude respiration varies very much, and chiefly according to the condensation of the lung; when this is very great the bronchial respiration is very intense, sometimes quite as loud as in the most severe cases of pneumonia. The condensation of the substance of the lung is, therefore, a circumstance which favors the bronchial respiration. The density of the effused liquid compressing the tissue of the lungs is another cause of the loudness of the bronchial respiration; if there be a large proportion of lymph, or a thick, viscid liquid in place of the usual thin serum, the conducting power of the substance which intervenes between the tubes and the ear is increased, and the respiration becomes almost as bronchial as if the lung itself were inflamed.

Thus in every case of pleurisy in which the effusion is at all considerable, there must be at least a rude respiration at the middle and posterior portions of the lung; for there the largest bronchial tubes are found, which are too stiff to yield to the compression of the liquid even if it be very considerable. The more external portions of the lung, however, which are composed almost entirely of the vesicular tissue, are so compressed as of course to cease to perform their functions.

When there is bronchial respiration in pleurisy the resonance of the voice becomes bronchial, and you will observe a true bronchophony. This has, however, a peculiar vibration or quivering in its tone, which never exists to the same degree in pneumonia proper. If the bronchial respiration is not so loud the resonance of the voice becomes less bronchial, but its vibration is increased, and its resonance is termed egophony. This takes place in those cases in which the effusion is but of moderate density, or little more thick than ordinary serum; and it is heard most distinctly from the anterior portion of the axilla to the scapula, and between this bone and the spine. It is, therefore, most evident when the bronchial tubes are moderately large, and there is a tolerably strong compression upon the vesicles. The depth of tone of egophony is modified by the density of the liquid more than any other cause; if the liquid remain thin, the egophony will continue; but in proportion as the density of the lung and of the

effused fluid approaches more nearly to that of pneumonia, the resonance becomes more like bronchophony than egophony. When the egophony is perfectly pure, it is less loud, and often less easily recognized than in those cases in which the body of sound is decidedly increased by the hardness of the lung.

This egophonic resonance of the voice is not, as may be readily seen, a sound of great importance in the diagnosis of pleurisy; for it requires for its production, in the first place, a moderate effusion only of liquid, allowing of the transmission of the sound, and therefore a moderate pressure upon the bronchial tubes. Hence the sound must cease entirely when the effusion is large, or else be converted into bronchophony. It is indistinctly formed also if the effusion consists mainly of lymph, and not of a considerable portion of serum; for this character of the voice is met with occasionally in hydrothorax as well as in pleurisy, showing that the same physical condition of the pleura may produce it in either case.

The friction sound is another sign of pleurisy, which is much more important than the resonance of the voice. It occurs under two different circumstances, at the beginning and toward the termination of the disease; that is, at those times in which the effused matter consists almost exclusively of lymph and not of serum; for if there be a large and thin effusion, the friction of the two surfaces of the pleura, which is the essential cause of this sound, will be prevented. When this sign occurs early in the disease, it of course takes place in the variety of pleurisy which may be termed dry, whether it continue in that stage or not; the friction is then very slight, and is inappreciable by many persons; it is more like the slight noise produced by rubbing together two pieces of tissue paper than anything else. At the close of the disease, after the absorption of the liquid, it is more regularly observed; indeed, I believe that the sign exists in every case, although very often it is overlooked by the physician. But it is often not heard unless the ear be applied about the lower angle of the scapula, at the moment the patient takes a full inspiration; it may be then distinctly recognized, and is often perceptible to the touch as well as the ear. It is then much louder, and offers the peculiar char-

acter of the true friction sound. This is sometimes quite permanent, lasting several days, or even much longer.

The friction sound is one of the most interesting connected with pleurisy, and its full value I have only been able to determine within the last few years. That is, by careful examination I have found that this sound is perceptible wherever there remains either such a moderate adhesion as to allow a little dragging upon the chest during the acts of inspiration and expiration, or where its movement is interfered with by the presence of a small quantity of lymph. The reason why the sound is so often overlooked, is that it very often is a sign rather than a sound; it is in some cases merely a slight jerking movement, with scarcely an appreciable sound. In other cases, the sound is heard even at some distance from the patient.

Sometimes, when the adhesions are only moderately intense, just enough so to interfere with the movements of the lung, I believe that this sign may last for years, perhaps even be permanent. I am sure that I have distinguished it in some cases several years after the cure of an attack of pleurisy. In many instances the patient himself is perfectly conscious of it, and will state that he feels a dragging sensation at the spot where the friction sound is heard.

The signs of the lungs, properly speaking, are of great negative importance in the diagnosis of pleurisy. In fact, it is at times impossible to distinguish the cases in which the lung is unaffected, in any other way. If, therefore, we find no signs of pulmonary disease, such as are indicated by the rhonchi and respiration, the case may be regarded as one of simple pleurisy. But, in order to form this opinion, we must take into the calculation both the general and local signs of pulmonary disease; and even then it will stand good only for the time, for we may be afterwards obliged to modify our opinion. Still, in simple pleurisy, it should be recollected that there are no signs of disease of the lungs other than those which arise from their consolidation by the pressure of the liquid. In practice, the complicated cases are probably quite as frequent as those which are more simple, for pleurisy is, to a certain degree, an appendage to all diseases of the lungs.

In the recovery from pleurisy, restoration to health takes place

but slowly, and the lung does not recover its natural power of respiration for a considerable time; the sound remains feeble, and the percussion dull; after a very long period, sometimes a year or more, the restoration to the natural fullness and softness of the respiration may take place; but this is not to be anticipated in the great majority of cases attended with a large effusion, in which the inspiration will often remain permanently feeble, and we must therefore be satisfied with a slow and gradual improvement.

The sound on the unaffected side usually remains preternaturally loud, because this lung is obliged to do more than its proportion of duty; thus there is an actual dilatation of the unaffected side. This increases the apparent disproportion between it and the contraction of the side which remains after pleurisy.

Symptoms. Besides the physical signs, there are other symptoms of pleurisy which are, to a certain extent, quite conclusive. These are generally most decided in the commencing stages of the disease, and may subside almost entirely and be almost forgotten by the patient. The diagnosis of the disease is therefore easiest, by the general symptoms, at its very commencement, when the physical signs are most obscure. We are also obliged to rely chiefly upon the rational symptoms in those cases of pleurisy in which old adhesions between the two surfaces of the pleuræ are so strong that of course no effusion can take place between them; this is always the case in pleurisy which has succeeded to a former severe attack of the same disease.

Of these local, but at the same time functional signs, the most prominent is the pain. This is so acute in many cases of pleurisy that the ideas of pain and pleurisy are very firmly associated in the minds of most persons, and they are apt to believe that all cases of pleurisy must be attended with pain: this is an error. For the pain may either be totally absent, or may be so obscure as scarcely to attract attention; it is then sometimes limited to a mere soreness along the portion of the chest most affected. When there is severe pain, it is almost always felt near the nipple; it is acute and lancinating, similar to that caused by the prick of some sharp instrument; hence it is in many languages called a stitch in the side. It is increased by motion, cough, or even

respiration. When the inflammation is very sudden and extensive, the pain may be agonizing, and for a time effectually check the respiration. A large quantity of effused liquid rather diminishes than increases the pain; and when it becomes large, as it often does, in chronic cases, the pain is often limited to a mere soreness, which is often seated in the loins instead of the thorax. This seems to depend upon the great weight of the thick purulent liquid. In diaphragmatic pleurisy, especially when caused by rheumatic or gouty disease, the pain is difficult to localize, and is generally wandering about the lower part of the thorax, causing more distress than other varieties of the disease. We see, therefore, that the pain is an important symptom of the disease when it exists, but that it is never lasting in the slow and moderately severe cases of pleurisy, and may be either entirely absent or badly characterized throughout the disease.

That the pain is slight in most cases of pleurisy, is clearly shown by one fact. If we ask any number of adults if they have ever had an attack of pleurisy, not more than one out of five will have any recollection of it. Now it is precisely because the disease has been attended with no pain at all, or with so little that it is entirely forgotten soon after recovery. Indeed, I am certain that a very considerable proportion of cases of pleurisy sufficiently severe to leave adhesions behind them, are not even suspected by the physician at the time of their occurrence. If there is a slight pain, it is ascribed to rheumatism or pleurodynia, and not to its real cause.

The cough is another local symptom: this is generally present in the milder cases of pleurisy, and is always short and almost insignificant. If the inflammation be very acute, the cough is almost entirely suppressed; and even in moderately severe cases it is in a great degree checked by the aversion of the patient to make the strong respiratory movement necessary to produce a full cough. It is not attended with expectoration in the simple inflammation of the pleura, for there is of course no secretion to be thrown off externally, unless the substance of the lung or the bronchial tubes are involved in the disease. Hence many of the remarks which we may find in some of the older writers upon this subject are in reality applicable to pneumonia, and not to pleurisy.

The more chronic the disease becomes, the less disposition is usually felt to cough, so that in cases of extensive empyema there is often no cough.

The mode in which the respiration is performed is sometimes of importance. In the beginning of the disease, when the pain is severe, the patient breathes chiefly with the healthy lung: this manner of breathing arises from the pain which is caused by the act of respiration as well as coughing. When the disease is more advanced the mechanical pressure upon the affected lung will prevent its expansion. Hence the patient throughout the greater part of the disease breathes chiefly by the healthy lung.

The frequency of the respiration in pleurisy is always greater than in health. At first this increased rapidity depends upon the fact that the full expansion of the affected lung is interfered with by the pain or inflammation. Afterwards the respiration becomes frequent, because one lung is exceedingly compressed, thus obliging the patient to breathe almost entirely by the healthy lung. Still the respiration is never so frequent as in many cases of pneumonia, seldom exceeding between thirty and forty to the minute, and often much less frequent.

The decubitus in pleurisy is sometimes of importance. When there is pain, we may state in general terms that the patient does not lie upon the affected side, which is extremely sensitive to pressure. Even late in the disease he will prefer the sound side, or the back; but when the effusion is so great that the weight of the liquid would press upon the mediastinum, and thus prevent the expansion of the healthy lung, he will naturally prefer lying upon the diseased side, and will thus relieve the healthy lung, which remains in a state fit for the performance of its proper functions.

The rational as well as physical signs which I have just described are those which belong to pleurisy considered chiefly as a local affection. There are many other symptoms which appertain to it in common with other inflammations of the serous tissues. These phlegmasiæ present a number of characters similar to those of other inflammatory affections, and some that are nearly peculiar to themselves. In general, the serous tissues, like other mem-

branes, modify the ordinary characters of inflammation, rather than offer others which are strictly novel.

At the commencement of all severe cases there is usually a chill, which varies in intensity from a slight sensation of coldness to a complete chill. This is generally felt at the same time with the pain — that is, the pain in the chest seems to excite the chill; it may return at several different times throughout the disease, but it then rarely offers the same intensity as on the first day. The chill is followed, of course, by heat, and by sweating, which occurs at irregular times and is not often very copious. During the disease the fever is generally persistent, and is characterized by a quick, tense, but rather small pulse. This is often called the pulse of inflammation of the serous tissue; and, although not regularly present in all cases of these diseases, it is found in a large proportion of them.

The sweats in pleurisy are sometimes extremely abundant, especially in the varieties of the disease that are complicated with a tuberculous development; but even in simple inflammation of the pleura they are sometimes very copious, and form a harassing and alarming symptom. In empyema, the character of the fever approaches the hectic type, and almost always assumes it when the operation of paracentesis has been performed, and a free communication is made between the external air and the purulent collection. In the latent form of pleurisy the fever may be quite moderate, rather a slow febricula than a perfect fever, and this is one of the causes which render this form of disease quite obscure.

The secondary irritation and inflammation of other viscera, which are so frequent in the inflammations of the mucous membranes and the parenchymatous organs, are very slight in pleurisy and serous inflammations in general. The disturbance of the alimentary canal is strictly proportioned to the intensity of the fever, and not to the gravity of the inflammation, which pursues a course almost unconnected with the viscera of the abdomen. The strength and the cerebral functions are usually just so far affected as naturally results from the severity of the pain and the degree of fever; they are, in themselves, very little disturbed by the inflamed pleura. Hence pleurisy is a remarkably simple disease if it be the primary affection; it frequently occurs as a

complication, but has little power to give rise to disorder of other tissues. This is explicable enough, when we reflect upon the simple structure and few nervous relations of the serous tissues. There is, however, one exception; that is, the tuberculous diseases whose development is sometimes singularly favored by pleurisy.

Diagnosis. The diagnosis of pleurisy is readily enough made in most instances: a well-characterized case is always certainly known, and can be confounded with no other affection. That is, when the distention of the chest, the dullness on percussion, and feeble or bronchial respiration coincide with dyspnœa, pain, and fever. If we restrict our diagnosis to the functional signs, we shall, of course, be somewhat puzzled in many cases; but with the aid of the physical signs, all decided cases can be mistaken for nothing else. In the slighter cases, where there is little or no physical change, this is not always the case: pleurisy may be confounded with pleurodynia, or simple rheumatic pain in the intercostal muscles and the adjacent fibrous tissues. The fever is a very uncertain test; but it has a collateral value, for it is more apt to accompany true pleurisy than simple pleurodynia.

The nature of the pain is a better one; for in pleurisy this is, to a certain degree, limited, and almost always is found about the anterior portion of the chest; but in pleurodynia it shifts about, and is often found on both sides at once; very frequently it disappears for a time, but soon returns, displaying in this respect the peculiar changeable character of rheumatic disease. When severe fixed pain occurs during the course of inflammatory rheumatism, we need not trouble ourselves about the diagnosis, for in such cases there is almost always something more than a mere rheumatic pain, and the pleura is positively, though perhaps slightly, inflamed. As a general rule, therefore, if in the suspected pleurisy the pain is at all constant, we may regard it as a true inflammation. The mobility of the pain is then the only good proof of pleurodynia.

There is no difficulty in distinguishing between simple pleurisy and pneumonia, or other diseases of the parenchyma of the lungs, with pleuritic complications; for the signs of true pulmonary disease are of course wanting in the one case, but present in the

other. The inflammation of the pericardium frequently occurs in connection with pleurisy of the left side, when it is sometimes extremely difficult to recognize it; for the signs of one disease, to a great extent, obscure those of the other. If the pleurisy attack the right side, the distinctive characters of the two diseases are quite evident.

Prognosis. In simple pleurisy our prognosis is almost always favorable, if we see the patient rather early in the disease. If the effusion be very large, or the disease be chronic, it is then quite doubtful; the mortality is totally different under these circumstances. In chronic pleurisy especially, the patient seems to die more from the fact of a large quantity of pus being reabsorbed with difficulty than from any other cause. Still, I believe that pus will pass through the process of absorption, but with more difficulty than ordinary lymph. In the secondary pleurisy, or in that variety which is accompanied by tuberculous disease, the prognosis is of course much less favorable. When the inflammation of the pleura precedes tubercles it usually ends in recovery, but afterwards phthisis will occur.

Treatment. The treatment of the ordinary pleurisy—that is, of the disease as distinguished from those cases in which pneumonia or phthisis plays the most important part, is based upon well-established grounds. It is strictly antiphlogistic, and, as in other inflammations of the serous membranes near the surface of the body, it is most effectual when we use local depletion in combination with or in addition to general blood-letting. The latter remedy, however, is always productive of great relief in the cases which begin with strong inflammatory symptoms—that is, much pain and dyspnœa; there is then no substitute for it. After we have taken a moderate quantity of blood, and have relieved the pressing symptoms, the indications are then rather to continue the treatment by local depletion and by diaphoretics than repeated general bleeding.

Cupping or leeching between the scapula and the spine, repeated if necessary two or three times, is then the best remedy. The effects of local bleeding are much more prompt in serous than in mucous inflammations or in diseases of the parenchyma of organs. Cups or leeches may be repeatedly applied in either

acute or chronic cases; but we will gain most from them if we choose the moment when the pain is acute; it will then often yield very quickly, and the disease improve after free local bleeding.

From the remarks already made respecting the history of pleurisy, it must be obvious that a large proportion of cases of the disease are not recognized during its course. Hence bleeding is not prescribed. This fact corresponds with a rule which I have for some years past been accustomed to lay down in practice—and that is, not to take blood from the arm unless the patient has decided pain and difficulty of respiration, together with some excitement of the pulse. If these symptoms do not exist, I confine myself almost entirely to local bleeding, which has the advantage of relieving the pain without enfeebling the patient.

There are several other local remedies which are effectual in diminishing the pain and inflammation besides cupping and leeching: these are warm poultices of hops, sprinkled with a teaspoonful or two of laudanum, and kept warm by placing over them a bottle or tin vessel filled with hot water, which should lie on the bed by the side of the patient. The narcotic acts with considerable energy upon the part, and its action is favored by the warmth and moisture.

In slight pleuritic pains, as well as in the true pleurodynia, sinapisms are eminently useful; but they are of little benefit in severe pleurisy. This not the case with blisters, which belong to that established class of remedies whose virtues have been tested by the experience of many generations; they are used with two objects in view—to relieve the inflammation and to favor the absorption of the effused fluid. While the inflammation is still advancing the operation of blisters is uncertain, and sometimes seems to be positively injurious; but after the active inflammatory symptoms have been checked, they are productive of decided benefit, and are perhaps of all remedies those whose action is most unquestionable. The acute pain often subsides immediately after vesication, and the absorption of the effused liquid sometimes takes place very quickly. The rapidity of absorption is not generally proportioned to the quantity of the serous secretion from the blister, although in a few cases a very copious discharge

will pour from the vesicated surface, and the pleuritic effusions may disappear in a few hours.

In chronic cases of pleurisy, blisters are among our most valuable remedies; but they should be small and very frequently repeated. My own plan is, not to make them larger than two or three inches square, and to apply them every two or three days, dressing the surfaces with simple cerate: you should, in this way, pass over a considerable part of the affected side by applying these small blisters successively to different parts of it.

In cases of pleurisy it is generally better to apply the blisters somewhere at the anterior portion of the chest, for less pain is caused by them there than anywhere else. In acute cases of the disease, it is best to apply blisters a little larger than those mentioned for the chronic variety—that is, about four or five inches square. For I believe that much of the advantage of blisters depends upon applying them of a size not sufficient to produce feelings of exhaustion after they have drawn.

When the pleurisy has been entirely or nearly removed, the patient often complains of slight returns of the pain from exposure to damp, or to a cold wind. The only way of guarding against these slight returns of the inflammation is to cover the affected side with a Burgundy pitch plaster, and to direct your patient to clothe himself warmly.

These, then, are the directly depletory remedies, and such as act as local counter-irritants. The internal remedies suited for the treatment of pleurisy are numerous, and applicable either to different cases of the disease, or different stages of the same affection. They may be divided into three principal classes: 1st. The antiphlogistic remedies, which are intended to relieve the inflammation and check the fever. 2. The remedies that promote absorption, which, however, are often fitted at the same time to check the inflammation. 3d. The anodyne, which may relieve the pain. Of course, in a strictly inflammatory disease, the first class of remedies and those which belong both to the first and second classes are the most important.

The tartarized antimony has long been used both in simple pleurisy and in the disease complicated with pneumonia; it is usually given as a diaphoretic, in the doses of a fourth to the twelfth

of a grain—rarely in larger doses. In these doses its nauseating influence is but slight. In the early stages of pleurisy, free diaphoresis is a powerful therapeutic agent; but in the more advanced cases, sweating is productive of comparatively little benefit; its good effects are most evident in those stages of the disease in which resolution is practicable before there is much effusion into the pleura—that is, it is a means of depletion from the vessels, and exercises comparatively little influence in promoting absorption. In chronic cases of pleurisy the tartar emetic should either be given up altogether, or restricted to very minute or merely alterative doses.

The tartar emetic is almost the only remedy which is nearly exclusively antiphlogistic in its action; most other internal remedies are more powerful from a combined action in promoting absorption and checking inflammation. The most important are mercury, nitre, and digitalis; squill and colchicum are also powerful remedies, and act like most other diuretics of a moderately stimulating character.

Of these the most efficient is mercury. Mercury, given in moderate doses, so as not to disorder the bowels, produces two distinct effects; one is directly antiphlogistic, the other is the influence which it exerts upon secretion and absorption. In the treatment of pleurisy in its active inflammatory stage, the first action of mercury is that which is most beneficial; in the advanced cases of purulent effusions, the inflammatory character of the disease is less marked, and the action of the mercury is chiefly limited to the absorption and elimination of the effused matter from the body. In the more acute cases we may give mercury more rapidly, in the chronic cases more slowly. Thus, I would advise a quarter of a grain to half a grain of calomel to be given every four hours if we design it as an antiphlogistic: it will then produce its specific effect in a short time, and the disease will generally decline. The mercurial treatment is, of course, but a sorry substitute for blood-letting, which it should follow and assist, but not replace. If the mercury be used toward the decline, or in the advanced periods of the disease, when our object is more to promote absorption than to remove the inflammation, we should give the calomel in much smaller doses—that is, of an eighth or a sixth

of a grain three or four times a day; this operates but slowly, and is much more effectual in increasing the power of other alteratives than if it is given in larger quantities.

The mercurials are usually combined with other remedies, which will work, as it were, in the same direction with them. Thus, in the early stages of the disease, Dover's powder, or the simple opium and ipecacuanha, may be given with them; if full diaphoresis is brought about by these means, the disease is more easily subdued. The Dover's powders should be given in doses of about three grains every four or five hours. The opium and ipecacuanha should be given in doses of a quarter or third of a grain of the former and from half a grain to one grain of the latter.

In the advanced stages, digitalis and nitre act admirably as diuretics. Digitalis should be given in doses of a grain of the powder four times a day, or the half of a grain to be taken more frequently. The tincture of digitalis may be given in doses of ten drops four or five times a day. These remedies are most beneficial during the acute stages of the disease. The nitrate of potash should be given, dissolved in flax-seed tea, in the proportion of about one drachm to a pint of the infusion. There are cases in which other diuretics of a more stimulating kind, as the juniper-berries or spirits of nitre, come in well; but these are chiefly such cases as approach very nearly to hydrothorax: there is then a feeble condition of the economy, and but little active inflammation.

The diaphoretics of a vegetable kind are, like many other remedies, adapted for various stages of pleurisy. In the early stages, full diaphoresis acts admirably as an antiphlogistic remedy, while in the advanced stages it may increase the absorption, and remove the effused fluid. The latter effect is, however, very uncertain: for the disease naturally tends to produce sweating, and the perspiration seems an abortive attempt on the part of nature to throw off the disorder—the curative action being quite disproportioned to the diseased one.

Anodyne remedies in the treatment of simple pleurisy are merely palliative, and are therefore rarely given alone. They consist almost entirely of some form of opium, except in those cases in which the patient is unable to take any preparation of

this drug; we are then compelled to resort to various substitutes. We must not, however, suppose that opium is insignificant, or of no value, because it is simply a palliative; for in pleurisy, as in other inflammations, the relief of pain prevents the increase of the disease, and is indirectly one of the effectual aids toward its cure. The only objections to its employment are to be found in those cases in which the cure takes place chiefly by secretions which must be thrown off from the body: this is not the case in inflammation of the serous tissue, for in these the liquid is necessarily retained until it can be removed by absorption and the adhesion of the coagulable lymph. There is, then, no permanent therapeutic contra-indication to the use of the opiates; if the skin be dry, they should be given in the form of Dover's powders, from eight to twenty grains of which may be given in divided doses during the day. If the sweating be copious, morphine will, as a general rule, be the best remedy, administered chiefly at night, in the ordinary doses of an eighth to a quarter of a grain. This is sometimes necessary for a considerable period.

When we find the pleurisy nearly well, but the patient still complaining of some dyspnœa or a little feverishness, and we discover on examination that a portion of the liquid remains unabsorbed, nothing is so efficacious as a journey, with its necessary consequence, change of air. Although the sea air is not always adapted to pectoral diseases, it is often of decided advantage in chronic pleurisy, especially if combined with a voyage. But as a course of this kind is necessarily attended with no little expense and inconvenience, and is totally beyond the reach of many of our patients, we shall be obliged to resort more frequently to land journeys, as a less troublesome and sometimes as efficient a course. This is generally the surest means of dissipating the remains of the disease and insuring a restoration to entire health. Of course, the usual hygienic precautions as to the dress should be adhered to.

There is no disease in which the treatment is more influenced by a knowledge of its symptoms and pathological relations than pleurisy; for, simple as it is, the success in chronic cases depends chiefly upon steadily watching the physical condition of the chest, and persevering in our care until the disease is entirely dissipated.

The diet in acute pleurisy should be light. The patient should at first live chiefly on vegetables, at least during all the active period of the inflammation; afterwards, however, it is necessary to give moderately nourishing food, such as soups, eggs, etc.; and toward the close of the disease a little more solid animal food, such as chicken, fish, etc., may be given. When the disease is nearly gone, it is a matter of importance to give the patient a somewhat nutritious and even stimulating diet, such as boiled or roasted meats. These, however, should be reserved for cases in which the affection has lasted for a length of time, and the patient's strength is considerably exhausted.

Stimulating drinks are not to be allowed at all during the early periods of the disorder; but toward its decline, when the patient is much enfeebled, a little wine or malt liquor may be allowed.

Exercise of a moderate kind, not sufficient to distend the chest, should also be enforced, especially toward the decline of the disease, when there is danger of pulmonary consumption.

VARIETIES OF PLEURISY

Besides its simple form, pleurisy presents many varieties which are, for the most part, connected with various structural alterations of the lungs, or with peculiar symptoms of the disease itself. I have already given a passing notice to several of them; but they require something more, as they constitute the most difficult cases of the disease.

There are also other varieties of the disease which differ from the usual form, but at the same time are not connected with any important change in the substance of the lungs; that is, latent and chronic pleurisy. These are sometimes closely connected together; thus, latent pleurisy with large effusion is almost always chronic, but chronic pleurisy is not necessarily latent. The same is not the case, however, at the commencement of the disease, for pleurisy may then assume the character of a latent disorder, and be even attended with a considerable effusion, without showing the usual symptoms; but the large effusions of pus, which are latent and unattended with the usual symptoms, always belong to the chronic variety of the disease. I shall first allude to the variety of it which follows a primitive acute pleurisy.

Chronic pleurisy. It is difficult in many cases to say what renders an ordinary acute pleurisy chronic; sometimes it is evidently a badly-treated case of acute pleurisy, and the inflammation continues, although some of its symptoms may cease. At other times the inflammation has either entirely resisted the ordinary remedies, or it has recurred after having nearly ceased. Both of these varieties present the same symptoms; the physical signs are nearly similar to those of acute pleurisy, but there is evidently an increase in quantity and weight of the effused liquid; hence the prominence of the chest and the entire want of resonance on percussion are all much more decided than in ordinary pleurisy, while the bronchial respiration is less marked, and the egophony gradually ceases.

The bronchial respiration gradually declines, partly because the bronchial tubes being pressed upon do not permit the air to pass through them readily, and partly because there is less tendency in the lung to admit the air. The latter fact is in accordance with the general law of the economy, which renders any portion of the body which is incapable of performing its function comparatively quiet; that is, there is less tendency to the active passage of air into the bronchial tubes than there was in the state of health. This may be explained by the diminution of the reflex action of the part.

There is no egophony, of course, because of the large effusion of liquid; but there remains more or less bronchophonic resonance of the voice, especially at the root of the lungs. This sign never entirely disappears, although it may be to some extent enfeebled if the effusion of liquid is sufficiently great to pass above the large bronchial tubes, and to a certain degree compress them.

I have already stated that the general signs of acute pleurisy, such as the inflammation, fever, and severe pain, may gradually disappear; but the fever is apt to recur, and changes its type, either resembling hectic very closely, or becoming perfectly identical with it. The fever is one of the most troublesome and alarming symptoms of this variety of pleurisy; for in other respects the patient does not suffer in a manner proportioned to the extent or the duration of the effusion. I once saw a patient who positively stated that he had performed the full duties of a

sailor, going aloft, etc., with an enormous pleuritic effusion; when he returned from sea, it amounted to more than two gallons. This is an exceptional case; but it is very frequent to find patients who can perform many laborious occupations without much inconvenience, and who at the same time are laboring under severe chronic pleurisy. It is generally the case if the dyspnœa be not very great; and we find that some patients complain of little difficulty of breathing with an extent of pectoral disease which will give rise to great distress in other individuals.

The symptoms which so frequently characterize chronic organic diseases are extremely variable in this variety of pleurisy; these are emaciation, loss of firmness of muscles, harshness and dryness of the skin, and slight œdema of the legs. Sometimes they are nearly as well marked as in tuberculous disease of the lungs—in other cases they are very slight; hence they constitute a diagnostic sign of the disease: and if we find them well characterized, we will do right to regard the case as one probably complicated with tubercles; if our impression be erroneous, we will soon rectify it, as the symptoms will gradually become more decided in the latter case, and slowly disappear if the pleurisy be followed by recovery.

The diagnosis of chronic pleuritic effusion is often quite impossible without the physical signs, for its symptoms are sometimes nearly similar to those of phthisis. When the physical signs of the disease are present, there is no difficulty in ascertaining it; but if it be complicated with tuberculous deposit, the case should be regarded as one of great danger, and the diagnosis is, as we shall afterwards see, much more difficult.

I have already alluded to the prognosis in this variety when speaking of ordinary pleurisy; it is always doubtful if the effusion be very large, for the liquid then consists nearly of pure pus, and of course the irritation caused by it may be sufficient to produce marasmus, and may, perhaps, deprive the patient of the strength necessary for a cure. The disease may occasionally, though rarely, prove fatal, from the mere obstruction to breathing. The liability of the disease to give rise to secondary tuberculous deposit, after the absorption of the pus, is also to be taken into our account: this forms a variety of the tuberculous pleurisy, in connection

with which I shall presently treat of it. There is another way by which chronic pleurisy may terminate fatally—that is, by producing metastatic abscesses in parenchymatous organs, as the lungs or liver; this result is, however, not at all common.

The treatment of chronic pleurisy differs so little from that of the acute variety, that I have treated of it at some length in connection with the latter disease. The inflammation is in both cases essentially the same; but, as it has become chronic, it requires chronic remedies, adapted to protracted cases; as a general rule, these should be such as are at the same time antiphlogistic, and favor the absorption of the pus. But in using these remedies we must not commit a common error, and attempt to force nature through a process which is necessarily a slow one; thus, if we subject the patient to what is called a vigorous treatment, we rather impede than favor the cure, and the strength may fail in the attempt. It is on this account that I advise the repeated application of small blisters, warm clothing over a large portion of the body—which is a mild but powerful means of counter-irritation—and the careful administration of the mercurials and other remedies favoring absorption.

Sometimes tonics are necessary in very old pleurisy, as in other diseases in which there is an abundant suppuration; for the strength may fail at the critical point when the largest demands are made upon it. In these cases, the most reliable remedies are the chalybeate preparations, which we may use from time to time, and occasionally either combine or alternate them with the vegetable tonics; but as the influence of the latter is much stronger in restoring the state of the digestive functions than in producing a decided alterative effect upon the general system, they are rather secondary remedies. I have already alluded to the good effects of traveling, and even of a sea voyage, in the treatment of chronic pleurisy.

There is another cutaneous tonic and alterative which may be properly combined with them; that is, stimulating baths, especially the sulphur and salt-water baths. These are generally taken at natural sources, by resorting to the sulphur springs or sea-bathing. They are much more powerful and more safe, taken warm, than cold, especially if we use the artifical baths. But sea-bathing, or

bathing in cold sulphur water, is sometimes, though rarely, advisable as a mere tonic, when the patient is simply debilitated, and the inflammation has subsided; they are always remedies which require some caution in their management.

In chronic pleurisy it frequently becomes a question whether the operation of paracentesis should be practiced. This is, as is well known, one of the most simple operations in surgery, and no one can meet with much difficulty in performing it; but, at the same time, it is often very serious in its consequences. There is a rule in surgery which is here strictly applicable; that is, that the exposure of a large suppurating cavity to the air necessarily excites hectic fever, and sometimes favors the development of secondary abscesses. The chances of recovery are not, therefore, on the whole increased by the operation, unless it be performed very carefully, and it is one which we should not practice, unless it be to relieve excessive dyspnœa, which may in itself be severe enough to threaten life.

Within the last few years, this operation has been frequently performed, in different parts of the United States, for the relief of empyema—among others, by my friend, Dr. Bowditch, of Boston. He, by taking the precaution of drawing the skin in such a way before the operation that the two orifices would not subsequently correspond, takes care to allow the opening to close perfectly. In this way it is easy to remove a large deposit of pus from the pleura, and at the same time the walls of the chest will sink in toward the lung, and thus favor the process of adhesion, which is necessary to the cure of all cases of pleurisy.

This mode of treating empyema is, however, one which I am reluctant to adopt, unless in cases in which the effusion is very great, so as to interfere seriously with the respiration, and give rise to decided hectic fever. In these cases I would not hesitate to perform it, especially if it be uncomplicated with phthisis; but if tubercular disease exists to an obvious degree, I must confess that the operation is always of doubtful benefit, and very often inadmissible. Indeed, in ordinary cases of chronic pleurisy, I would not dream of performing it, unless the disorder had resisted the usual means; then it is sometimes advisable. For the mode of performing it, the reader is referred to works on operative surgery.

The diet in chronic pleurisy should be light but nutritious. That is, the patient should be advised not to carelessly partake of stimulating meats, but to confine himself to such articles as eggs, chickens, oysters, and the like. Very rarely, a little porter or ale may also be given.

After chronic pleurisy has ended in recovery, there always remains a more or less considerable distortion of the chest. The affected side, which was distended during the more active stage of the disorder, sinks in very notably, and produces a marked alteration in the conformation of the individual. Thus an experienced eye will often recognize at a glance cases in which the patients have recovered from chronic pleurisy. The chest is contracted on the affected side, which contraction is always visible when the patient is partly or entirely undressed; but even in cases in which he is walking about, the contraction is sometimes readily seen, the shoulder being depressed on the affected side, and the intercostal muscles contracted.

Latent pleurisy. This is another variety of the disease: like all latent inflammations, it is not indicated by the usual functional signs. These are, in pleurisy, pain, cough, dyspnœa, and fever, all of which may be either wanting, or so obscure as scarcely to attract notice. When the disease is slight and latent, it passes through its stages without notice, and the patient usually forgets the trifling indisposition under which he may have labored; it is in this way that adhesions are so frequently found in the pleuræ of persons who have no recollection of the symptoms of the previous inflammation. When the latent pleurisy is more severe, it gives rise to more decided symptoms; but these are very slow in their progress and formation, and increase very gradually, producing a disturbance of the general system, attended with slow wasting of strength and slight fever, rather than with any symptoms which point decidedly to the local inflammation. A disease which begins in this way is necessarily an obscure one, and may imperceptibly attain a degree of severity which will either render it fatal of itself, or, as is much more frequent, give rise to other disorders, especially of the tuberculous kind. Indeed, many cases of tuberculous pleurisy are, in their nature, more or less latent; for the peculiarity of latent pleurisy consists merely in

the absence of the ordinary local signs; it may or may not be complicated with tubercles. When these are found in pleurisy, the symptoms are generally less distinct than in the ordinary varieties, but not in other respects very different.

The diagnosis of latent pleurisy is of course more difficult than that of any other variety of the disease. It depends chiefly upon the physical signs of the local mischief, and partly upon the evidence of general disorder of the economy. When the disease is attended, as it often is, with considerable effusion, there can be no difficulty in deciding as to its nature, provided all the physical signs can be detected; that is, the dull or flat percussion, feeble respiration, and egophony: and as the friction sound can almost always be detected in the early or later stages of the disease, it renders the diagnosis still more easy. But if the signs be limited to the mere feebleness of respiration and dullness of percussion, we must take care not to confound the disease with an enlargement of the liver, or a chronic consolidation of the lung. As a general rule, however, the physical signs of latent pleurisy are tolerably well marked in all severe cases, when we compare them with those constitutional symptoms which are commonly caused by the disease.

These generally pursue the following order: a patient previously in good or passable health is taken with a slight or a severe chill, which is sometimes so short that he is scarcely conscious of its occurrence. The chill is soon followed by a slight fever, increasing a little toward the close of the day, but rarely severe enough to destroy the appetite; this is, however, a little diminished, while the thirst and dryness of the skin are rather increased. There is often a slight hacking cough, but the expectoration is altogether or nearly wanting. The strength of the patient is a little enfeebled, but not enough to prevent him from attending to his ordinary business. These symptoms are so slight that most patients are totally unable to localize their disease. It is, indeed, often so difficult of recognition, that I have known several experienced physicians, who were laboring under this affection, without being able to make a positive diagnosis in their own case.

If we remember, therefore, that latent pleurisy is rarely important, unless it be discoverable by the physical signs—for in

no other case does the effusion take place to any great extent—seldom shall we meet with much difficulty in recognizing the disease. The common source of error is in distinguishing between it and pulmonary phthisis, which is sometimes excessively difficult, for the one may often be complicated with the other. This is particularly true of tuberculous pleurisy, in which there is an actual deposit of tubercles, either in the pleuræ or the lungs, and yet the ordinary symptoms of pleurisy are present. As this subject rather belongs to phthisis than proper pleurisy, I do not wish at present to enter more at length into this matter. It is one of those things which are most difficult to describe: the diagnosis depends upon a number of circumstances which in themselves are unimportant, and acquire value only from their combination.

The prognosis of this form does not differ from that of other varieties of the same disease—that is, of those which are equally chronic; and except in the cases in which the disease passes into the tuberculous form, it generally terminates favorably; if it be long neglected, however, the disease is apt sooner or later to be transformed into pulmonary phthisis.

The treatment of latent pleurisy does not differ in any respect from that of the ordinary chronic forms; and I need not, therefore, repeat what I have already sufficiently entered into. The treatment should be continued until all physical signs of the disease are passed away, and the general healthy appearance of the patient is entirely restored.

This is a form of the disease which is very readily overlooked, unless the physician is thoroughly on his guard, in which case it may be easily enough recognized by means of the physical signs. Thus I have often detected it in cases in which its existence was not even suspected before a careful physical examination had been instituted.

Secondary and complicated pleurisy. Pleurisy is secondary to many other diseases; these may be either the affections of the lungs proper, or of the economy in general. When pleurisy occurs during the course of a disease of the lungs, it is most apt to develop itself when the external portions which are nearest to the serous membranes are affected: thus, pneumonia, gangrene,

and phthisis, which are the diseases most frequently followed by pleurisy, are often not complicated with it until the disease has advanced from the central parts of the lung, where they generally begin, to the surface; hence the pleuritic stitch or pain may not be felt until a comparatively late period. As a general rule, all affections of the lungs which approach the pleura will give rise to pleurisy, which is the surest safeguard against perforation of the membrane.

These cases of secondary pleurisy are generally classed with the diseases of the parenchyma with which they are connected, for they are much more important disorders. The treatment is especially directed toward the pleurisy only so far as it is designed to remove pain. In other respects the same mode of treatment which is proper for the removal of the inflammation of the parenchyma will usually relieve the disease of the serous membrane. The serous inflammation may occasionally prove more severe than the parenchymatous disorder; thus, there may be but little inflammation of the substance of the lung, and rather a large effusion into the pleura; this variety is called pleuro-pneumonia, but is very little else than a pleurisy aggravated by the pulmonary disease.

The tuberculous pleurisy is a disease of some importance: in certain cases it is consecutive to the tuberculous deposit in the parenchyma of the lungs, and is then strictly secondary; in another class of cases the tuberculous deposit takes place in the pleura, and is followed by the inflammation; and in a third, the inflammation occurs in an individual who is previously in good health, or at least free from evident tuberculous disease of the lungs, which does not occur until the inflammation has taken place. The first two varieties belong exclusively to the subject of pulmonary phthisis; the latter is rather a cause than a consequence of it—hence it merits some notice in this place.

The third class I would divide into two subdivisions—in one of them the tuberculous disease of the lungs occurs after the pleurisy has lasted for some time, or the effusion has perhaps been partially or entirely absorbed. It is difficult to say why a simple pleurisy should be more frequently followed by tubercles than pneumonia, yet such is the fact; or at least there are many cases

of pleurisy in which neither attentive observation nor careful reasoning can lead us to suspect the occurrence of tuberculous disease during the active period of the inflammation, although it is developed in its declining stage or at its close. If I were to hazard a theory, I should say that the singular analogy between the irritative fever from pleuritic inflammation with purulent effusion and that resulting from the acute tuberculous disease shows that there is a close alliance between the two kinds of morbid action. This explanation, however, even if its correctness were perfectly proved, does not entirely solve the difficulty; but it is certain that the very different ways in which tubercles accompany pleurisy prove that the mere absorption of pus will not account for it in a large proportion of cases, although the transmission of the purulent fluid through the system must be more or less deleterious, and, like all enfeebling agents, it may break up the constitution and favor tuberculous diseases.

The second mode in which tubercles seem to arise from pleurisy is probably rather more frequent than that which I have just described; the pleuritic inflammation occurs in healthy individuals, or those who are apparently healthy; and in the serous membrane, as well as in the coating of coagulable lymph or false membrane, we find a great number of minute granulations of various size—some barely visible, others of the diameter of half a line or a line—each surrounded by a beautiful net-work of vessels passing to them. The granulations are, as a general rule, most numerous where the vessels are most developed, although this is not invariably the case. In this variety it would be an abuse of reasoning to conclude that the tuberculous granulations had existed in a latent state, and were followed by the serous inflammation; for they are, for the most part, equal in size, and evidently of extremely recent origin, some of them often appearing in the false membranes, which are necessarily consecutive to the pleurisy. There is, of course, something besides the pleurisy; for all cases of inflammation do not give rise to tubercles, although the exciting causes of the disease, when complicated with them, are the same as of ordinary inflammations. This variety of pleurisy has been little noticed by writers; indeed, we do not, I

believe, find that its true value as a cause of tuberculous disease of the parenchyma of the lungs is anywhere pointed out.

The varieties of tuberculous pleurisy which are consecutive to pulmonary phthisis belong more properly to the history of the latter disease than to that of pleurisy proper. The other anomalous products which occasionally take place in the lungs are often complicated with pleurisy; and in a few rare cases we shall find that the cancerous or melanotic substance is secreted simultaneously with the serous inflammation; this disease is similar in many respects to tuberculous pleurisy, but possesses little or no practical interest.

CHAPTER VII.

BRONCHITIS—ACUTE VARIETIES—SIGNS AND TREATMENT OF ACUTE VARIETIES—BRONCHITIS OF THE OLD—CHRONIC VARIETIES—PECULIAR VARIETIES.

HAVING concluded the subject of pleurisy in its various forms, I might now pass to that of pneumothorax, as in this affection the same membranes are involved; but inasmuch as bronchitis is of more frequent occurrence, and, like pleurisy, in very many cases complicates or gives rise to affections of the parenchyma of the lungs, I think it comes in very well in this place, and I shall therefore now proceed to treat of this disease. The term *bronchitis* is, in common parlance, applied to various affections of the respiratory organs, as laryngitis, several affections of the lungs, etc.; but it should never be used in this way by physicians, as it is vague and unphilosophical. The term must be confined to inflammation of the mucous membrane of the bronchial tubes.

Bronchitis, like all other inflammations, is divided into *acute* and *chronic*. The acute has been subdivided in reference to the greater or less quantity of the secretion, and its epidemic or sporadic nature. The first division is of very little importance; but the second is well founded, as the disease is much more serious when it occurs in an epidemic form. In the epidemic bronchitis, to which the name influenza has been given, the severity of the constitutional symptoms is by no means proportioned to the intensity of the local lesion, the latter in many cases being very slight, while the former are very often sufficient to confine the patient to his bed for several days. The constitutional symptoms are pains in the back, etc., high fever, and extreme prostration.

Anatomical lesions. We have no opportunities of examining the anatomical lesions in simple acute bronchitis, as the disease

is seldom or never fatal. On this account we can only study them in cases in which it is secondary to other grave diseases, and in these cases we often meet with every stage of bronchitis. In this disease the mucous membrane itself is chiefly involved, and not the subjacent tissue, as is the case in serous inflammations. The lesions observed are injection of the mucous membrane, ecchymosis, thickening, softening, and induration. The last-mentioned lesion may perhaps occur in primary acute bronchitis, although it cannot be demonstrated; but in cases where the affection is secondary to some other disease we frequently meet with it. The lesions are found to be more marked in the minute than in the large bronchial tubes, although the signs of inflammation of the larger tubes may have been very decided before death.

In anæmic patients the mucous membrane, instead of presenting increased redness, is found to be pale; the only change which is perceived is that the membrane becomes more opake, while in a healthy state it is almost transparent. This appearance is not at all uncommon in persons whose blood is deficient in red globules at the time of the occurrence of the affection.

In acute bronchitis ulceration rarely takes place, although it is by no means infrequent in the chronic form of the disease. In the more acute variety it is almost entirely confined to those cases which have a specific character, as when bronchitis complicating rubeola and variola. In these cases the ulcers are at first confined to the follicles, although they sometimes extend themselves until these acquire an irregular outline, involving the surrounding membranes. Ulceration affects principally the trachea and larger tubes, where the follicles are well developed, and rarely extends to the minuter ramifications of the bronchial tree. I shall not dwell upon this lesion at present, as it does not deserve much attention in this place.

There is, however, another modification of much more importance, viz., the effusion of lymph and formation of false membrane. This form of inflammation, which has been termed diphtheritis, occurs also in severe cases of croup. It is not met with in the usual forms of the disease, but occurs chiefly at particular seasons and in certain localities.

When bronchitis commences in the small tubes and extends upward toward the larynx, it is sometimes, though not frequently, fatal; but when it follows the opposite course, beginning at the larynx, and extending downward, it may be easily arrested, and the disease will almost always terminate favorably. Inflammation of the bronchial mucous membrane is in some cases attended with a serous effusion, which, occurring under the membrane, gives rise to œdema: when this takes place in the upper portion of the larynx, it constitutes œdema of the glottis.

Bronchitis tends, in most cases, to get well without the formation of pure pus, although more or less purulent secretion is generally combined with mucus, at some stage of the disease. Its progress is as follows: at the commencement of the inflammation the membrane is injected and thickened, and its secretion is arrested. An increased secretion then takes place, which is intended by nature to relieve the turgescence of the vessels: if the inflammation continues, the secretion then becomes opake; if it be not arrested at this stage, but still goes on, purulent globules are mixed with the mucus, and in more protracted cases pure pus is secreted. The expectoration, however, is never found to consist of pus alone, because, although certain parts of the membrane secrete a notable quantity of this liquid, yet before it is expectorated it is mixed with mucus from other portions.

Bronchitis may occur as a primary disease, or as secondary to some other affection of the lungs. When it occurs as a primary affection, it may either terminate in perfect recovery or may give rise to the development of some lesion of the parenchyma of the lungs, such as pneumonia or phthisis. The former is the more common termination, but the latter is not infrequent.

In other cases the bronchitis supervenes on one of these affections, which may promote it, or rather may involve the bronchial tubes with the parenchyma. This distinction is of the greatest importance in forming a prognosis; for when the disease is secondary it is merely a part of the tuberculous disease; when it precedes this affection it may advance to a certain length, and the tubercles may then be secreted.

Symptoms and physical signs. We now come to the signs which indicate acute bronchitis. These may be divided into

general and *local.* The general signs are febrile excitement, with its attendant symptoms of enfeebled strength, loss of appetite, and thirst. The local signs are cough, expectoration, soreness of the chest, with the physical changes in the respiratory sound. In treating of the local signs, I shall first consider those connected with obstructions to the passage of air through the tubes. The sonorous rhonchus is generally heard in the first stage of acute bronchitis: it is produced by the thickening of the mucous membrane of the larger portions of the tubes, which contracts their caliber, and thus impedes the passage of air through them. I described this rhonchus in a previous chapter, and pointed out its distinctive characters. As it often occurs first at the root of the lungs, where bronchial respiration is loudest in pneumonia, we may, unless we are attentive to the distinctive characters which I have laid down, mistake it for the latter sound: it is important to bear this in mind. The sonorous rhonchus is heard in the larger tubes; but when the inflammation extends to the smaller tubes, a sibilant rhonchus is produced, which is caused by the same physical condition as the sonorous, but differs from it on account of the smaller caliber of the tubes in which it occurs.

The sonorous rhonchus is very variable in ordinary cases of bronchitis; appearing and disappearing almost with each act of respiration. Sometimes the sound is heard in inspiration only, in other cases in expiration, and in others again in both; it is in these latter cases that the sound may sometimes be confounded with the bronchial respiration; that is, if the sonorous rhonchus does not happen to have a very musical intonation.

Although these rhonchi are very frequent, yet if we expect to meet with them in all cases of acute bronchitis we will be egregiously mistaken, because the thickening must reach a certain point before the sound is developed, and therefore if it does not proceed thus far no rhonchus will be heard. Feebleness of respiration is a more constant sign in bronchitis: it results from the air not passing freely through the tubes; but, like the rhonchi themselves, this sign is extremely variable, shifting from one portion of the lung to another, as it is temporarily influenced by the efforts of breathing, which force the air into the lungs, and for a time clear the tubes.

In this affection the chest sounds perfectly clear on percussion

in the first stage; it sometimes, however, becomes a little dull in the second, but the alteration is very slight, and is limited to those cases in which congestion of the parenchyma coexists with the bronchitis.

In the second stage of the disease secretion takes place into the bronchial tubes, which gives rise to the moist rhonchi, mucous, and subcrepitant. The former, like the sonorous rhonchus, is produced in the larger bronchial tubes, the latter in the smaller. The mucous rhonchus is not, however, constant, but it appears and disappears in various portions of the lung, even after the patient expectorates freely; and in the slighter attacks of the disease it will scarcely be heard, and only at the close of the disease, after secretion has fairly commenced.

In the light attacks of bronchitis the mucous rhonchus is often limited to the base of the lungs, or it may extend to the large bronchial tubes at the root without passing through the whole of the structure. In some cases in which there is an abundant secretion the moist rhonchi, both mucous and subcrepitant, are almost always permanent, and they usually extend through the whole or a great part of the lungs, although most abundant at the lower part, never ceasing entirely, notwithstanding the patient has expectorated with some facility. The subcrepitant rhonchus resembles very much the crepitant, which is peculiar to pneumonia: this renders the diagnosis somewhat difficult, as the cases in which it occurs simulate this disease very much—the real inflammation of the parenchyma. When, however, the bronchitis is of considerable extent, the difficulty in making diagnosis between these inflammations diminishes in most cases; for the latter disease scarcely ever extends to a large portion of both lungs, as is often the case with bronchitis.

In some cases of bronchitis, mucous rhonchus is present almost from the very commencement of the disease—that is, it occurs simultaneously with the sonorous rhonchus, or it may sometimes be heard alone. The early appearance of the mucous rhonchus depends partly upon the character of the disorder, and partly upon the individual condition of the patient; for in some cases we find that there is a much more abundant and earlier secretion of mucus than in others. When mucus exists in the bronchial tubes, there is of course a corresponding rhonchus.

The diminution in the secretion sometimes precedes the resolution of the cough, so that the patient may have scarcely a trace of rhonchus, although he is still coughing more or less. This results from the persistence of the irritation in the bronchial tubes, which causes the cough, although the subsidence of liquid secretion has, of course, destroyed the mucous rhonchus.

The spot at which the mucous rhonchus in bronchitis is always most marked is at the base of the lung on each side. It is generally more decided on the right side, simply because the right lung is the larger. This sound is not, however, confined to any portion of the lung; it may occur anywhere, but is always produced in the larger tubes. Hence, if the sign occurs in the upper part of the lung, it is not usually permanent, although it sometimes may be so, for expectoration will almost always remove the small quantity of mucus which is contained there. At the base of the lungs, however, the rhonchus is much more persistent, for no effort of coughing is able to remove entirely a large quantity of mucus from that part of the tubes. Indeed, in any case of severe bronchitis, in which mucous rhonchus exists abundantly over the whole chest, we may find that this sound is not much influenced by coughing; for although the effort of coughing will easily remove a small quantity of mucus, and of course destroy the accompanying rhonchus, yet it has comparatively little effect upon this liquid when in large amount.

The subcrepitant rhonchus, to which we have already alluded, always occurs in what may be termed the worst cases; that is, either in those in which pneumonia is imminent from the excessive congestion of the lungs, or in cases in which the inflammation extends to the finer tubes, producing in that way a rhonchus with smaller bubbles.

After secretion occurs, the mucous membrane becomes less thickened, so that the dry rhonchi quickly diminish, and the respiration gradually returns to the normal state: but for a time it may be more or less mixed with moist rhonchi; that is, the mucous and subcrepitant. These gradually cease as the resolution of the disease advances.

The percussion in ordinary cases of bronchitis remains perfectly clear; for there is no alteration of the substance of the lung suffi-

cient to modify it. The only exceptions to this rule are in cases of bronchitis attended with great congestion of the posterior portion of the lung, where the percussion may be a little dull. This is, however, oftentimes scarcely perceptible. There are in fact some cases of bronchitis in which the rhonchi are dry, and of course there is but little secretion, in which the percussion is even clearer than in the majority of healthy subjects.

The expectoration in acute bronchitis is very variable: at first, as the cough is dry, there is little or no expectoration; but as the disease advances toward resolution, or passes into a more chronic variety, the expectoration becomes much more abundant, and consists of frothy sputa which are almost peculiar to this disease. When the disorder is still slight, or if it remain stationary, the sputa are generally transparent, and consist merely of thin mucus. As soon as it tends decidedly toward resolution, or if, instead of tending toward resolution, it assumes a subacute form, and approaches a chronic condition, the character of the sputa changes—they become more thick and opake, and of a whitish color. If the disease be more severe, a small quantity of purulent matter is sometimes mixed with the sputa, and they assume the muco-purulent character. In these cases their form is irregular, and the thicker portion is generally diffused in shreds through the thinner part. As the disease declines, the sputa gradually become less and less abundant, and lose their muco-purulent appearance, being converted into simple mucus. If the inflammation be very violent, the secretion from the bronchial tubes becomes almost of the consistence of coagulable lymph, and is firm, and molded into the form of the bronchial tubes; these tubes, or polypi, as they are sometimes called, indicate a high degree of inflammatory action.

The physical signs of primary acute bronchitis differ but little from those of other forms of the disease, such as the chronic, etc.; but the general symptoms are somewhat different—they are usually very well developed in epidemic cases, and are comparatively slight in the sporadic. The patient is first taken with a chill, which is followed by febrile excitement, thus resembling other inflammations, as well those of serous membranes and of the substance of the lungs, although it is of much less intensity. The

patient then has slight fever, and sensations of chilliness occurring at different times, restlessness, heat in the palms of the hands, etc. The condition of the pulse is in perfect correspondence with the moderate fever, rarely exceeding eighty or ninety in the minute. In epidemic bronchitis the condition of the patient may be very different; the pulse is often small, compressible, and frequent; there is great prostration and disturbance of the nervous system; and, consequently, the tolerance of loss of blood is much less than in serous inflammations. There are other symptoms, depending upon the febrile excitement, such as anorexia, thirst, and headache.

There is another set of symptoms which is secondary, and belongs to affections of the other tissues, principally the serous: of these the inflammation of the pleura is the most common, producing pain, which is increased during the act of inspiration. The pleurisy which sometimes though rarely supervenes upon, or complicates bronchitis, is very slight, and is usually dry; when the pleurisy is considerable it is looked upon as a primary disease, of which the bronchitis is a complication. This accidental pleurisy may prove a cause of death in certain cases; when, for instance, there is hypertrophy of the heart, or when the patient is loaded with fat, it produces this catastrophe by increasing the dyspnœa which usually attends bronchitis, when it attacks the same individuals. The danger in these cases arises chiefly from the pain which impedes the respiration: in simple bronchitis the pain is slight, and often limited to a mere soreness.

This soreness is almost always felt across the anterior portion of the chest. It is not limited to a single spot, as in most cases of pleurisy; nor has it the sharp and cutting character of the pleuritic pain. The degree of it varies very much in different cases; some patients complain of it as a most painful symptom, others only speak of it when their attention is called to it by the physician. As a general rule, the pain is most severe in those cases where there is comparatively little mucous secretion, while it is much less when the expectoration is abundant.

Acute bronchitis generally lasts but a few days, and its termination is in almost every case favorable. It sometimes, however, runs into the chronic form. This may depend upon the peculiar

susceptibility of the patient to inflammation of the mucous membrane, or the unfavorable hygienic circumstances in which he is placed. In some cases it leads to the development of tubercles in the lungs; this, most commonly, is owing to a decided tuberculous diathesis of the individual affected with it.

In some cases acute bronchitis favors the development of acute pneumonia, which it may precede by a certain time. It always accompanies every important disease of the substance of the lung, for the bronchial tubes passing through the diseased organ will necessarily become inflamed. Hence, in phthisis, pneumonia, etc., we must carefully discriminate between the serious disorder of the lungs and its accompanying bronchitis.

Diagnosis. The diagnosis of acute bronchitis is generally quite easy. Beginning, as the disease generally does, as an acute affection, it can only be confounded with pneumonia or pleurisy. In some cases, indeed, bronchitis is merely the commencing stage of the pneumonia, which soon masks its symptoms, and then becomes the principal affection. The distinction between these diseases is to be looked for partly in the expectoration, which is very different, and then in the absence of the characteristic signs of pneumonia, such as bronchial respiration and crepitant rhonchus. In pneumonia, too, the patient is generally very ill, and obliged to keep his bed, but in bronchitis he is still able to walk about his room, if not to go out of doors. There is sometimes, however, a difficulty in distinguishing cases in which the bronchitis is extensive and is followed by a limited pneumonia, but in these cases the best distinctive marks must be sought in the characteristic physical signs of each of those affections.

The distinction between bronchitis and pleurisy is, in general, quite easy; the symptoms of the two affections, as well as the physical signs, are of course totally different. Phthisis, in some cases, is with difficulty distinguished from bronchitis; much attention must be given to the general symptoms of the two disorders, and the progressive emaciation and the frequency of the pulse will generally point out those cases of phthisis in which the physical signs are not very evident. When there is much physical obstruction at the summit of the lungs, the case is evidently phthisis, although it may be complicated with catarrh—that is, with slight bronchitis.

Prognosis. The prognosis of bronchitis is, as a general rule, quite favorable; there are, however, exceptions to this rule. These occur chiefly in the aged, and in young children. We therefore always feel more uneasiness about the disease when it is seen in an aged person; it is in this class of individuals, however, more dangerous, because it is apt to terminate in pneumonia, rather than from any immediate symptoms in the acute forms. In young children, the danger depends almost entirely on the same disposition to obstruction and consequent inflammation of the parenchyma of the lungs. As a general rule, we may state that when the oppression is but moderate, and the expectoration continues to be free, there is little danger with the aged. In children, if we find the respiration continues free, we know that there is but little danger; but when the oppression becomes considerable, the child is almost always on the point of passing into pneumonia, a disease in which the prognosis becomes much less favorable than in ordinary catarrh.

Treatment. The treatment of bronchitis is simple, and its description will occupy but a short time. We find in some books a regular course laid down for the treatment of this affection, the first step of which is, in severe cases, the abstraction of blood. Bleeding is unquestionably a most useful remedy; but it should not be prescribed for all patients indiscriminately, for the milder cases get well very rapidly without it. We should only resort to it in severe cases, for there are other means by the use of which we may cause the disease to abort, without the inconvenience resulting from the use of general bleeding.

Cupping is, in fact, in most cases of bronchitis, a better remedy. In the first place, it relieves the inflammation, at least as well as the abstraction from the arm of a little quantity of blood would do. In the next place, cups act as a decided counter-irritant. They should be applied usually between the shoulders, since in that position they are nearer to the bronchial tubes, and besides abstract a larger quantity of blood. Sometimes I repeat them once or twice, but in most cases a single cupping will be found sufficient. Indeed, even this is far from being necessary in every case of the disorder; for a large majority of the cases of bronchitis will get well very easily, and with little inconvenience to the patient, without the loss of a single drop of blood.

Blisters are sometimes useful. I always apply them, as is my usual practice in diseases of the chest, in front, so as to avoid the inconvenience resulting from excoriation on the posterior surface of the body. They may be about four or five inches in diameter, and should be applied at about the middle part of the chest. One application is usually quite sufficient, and the remedy should be used only in those cases in which the inflammation is both persistent and severe.

Other counter-irritants, such as mustard foot-baths and weak sinapisms to the chest, are frequently of service, especially in those cases in which the inflammation is attended with an abundant secretion. At the close of the disease we may often place upon the chest of the patient a Burgundy pitch plaster, or a diluted warming plaster, to be worn for a considerable period. These remedies, however, should be reserved for severe cases of bronchitis.

Ipecacuanha and tartarized antimony produce a decided effect on the disease. The latter is not always well borne, and ought to be used in large doses only in severe cases, as it may cause much irritation of the stomach. I give it usually in very small doses, sometimes in lemonade or neutral mixture, the object not being to excite severe nausea, but to produce a sedative effect. Dr. Physick has the credit of originating a remedy which was much used in Philadelphia some years ago. It consists of tartarized antimony, gr. ij; bitartrate of potassa, ʒij; dissolved in one quart of flax-seed tea, to be taken, in divided doses, in the course of twenty-four hours. This remedy is not altogether safe, for if the patient should drink a large quantity of it through mistake, it would probably produce very unpleasant symptoms, as tartarized antimony diffused in a large quantity of any fluid is very apt to bring on violent inflammation of the mucous membrane of the alimentary canal, though the quantity taken be not very large. Antimony may be advantageously combined with opium. Some give a dose of opium alone in the commencement of the affection; I prefer, however, a combination of this kind, which produces diaphoresis, and often affords very speedy relief. We may give an eighth of a grain of tartarized antimony with the same quantity of morphia. This may be repeated two or three times a day, or it may be varied to suit the case.

Ipecacuanha is borne much better than tartarized antimony, and is a much safer and better medicine in this disease. I give it in just sufficient quantities to create a slight feeling of nausea—from half a grain to a grain every two, three, or four hours; or from ten to twenty drops of the wine of ipecac. at the same intervals. Occasionally I combine a little opium with this remedy—that is, if I find that there has been free secretion. Thus the patient may take one-sixth of a grain of opium from two to six times a day, according to the effect produced. I would not, however, persist in it if I found that the secretion from the lungs was arrested, or any sensation of tightness produced.

When the disease does not subside at once after active treatment, the patients generally ask for something to allay their cough. In these cases many cough mixtures are used, most of which are beneficial in their effects. They contain a narcotic, nauseating, or stimulating ingredient, and sometimes a combination of these, commonly mixed with mucilage of gum-arabic, which fulfills the indication of allaying the irritation about the throat. A remedy in very general use is the *Brown mixture*, the composition of which every one is well acquainted with. A mixture commonly used is one of the sirups of senega and squills, to which opium may be added if necessary; but we should be very cautious about giving opium in mixtures to children, as the accumulated effect of repeated doses may arrest the secretions, and produce other dangerous results. Another mixture of which I am fond, consists of the sirup of squills and tincture of lobelia—twice the quantity of squills to that of the lobelia, a teaspoonful being taken every few hours. Another consists of the squills with the addition of ten drops of the wine of ipecac. to each teaspoonful; this also answers well. Certain stimulants are frequently given with advantage toward the close of acute cases, and are very useful in the chronic forms of the disease; these are gum ammoniac, balsam of Tolu, balsam of copaiba, etc.

The precautions necessary to be observed in convalescence are the same as in other acute diseases. The general indications, therefore, in the treatment of bronchitis, are, if possible, to bring about a cure of the disease by resolution; this rarely takes place without a secretion of mucus from the membrane. Hence, if you

prevent the fever and local inflammation from running sufficiently high to impede secretion, either by blood-letting, or nauseating or stimulating diaphoretics, you produce nearly the same effect. After this object is attained, the local stimulants which tend toward the lungs favor very much the secretion of mucus, which is almost essential for the removal of the disease.

The diet of patients affected with acute bronchitis ought always to be very light. Animal food should even be excluded for a few days, if the disease be at all severe; it should afterwards be allowed, but it must of course be of a mild, unirritating kind. No stimulants should on any account be given.

There are several circumstances which modify this affection to a considerable degree. The most important of these is age—the bronchitis of children and of old men being very different from this disease as it occurs in adults.

VARIETIES OF BRONCHITIS.

Bronchitis of children. The bronchitis of children is particularly interesting; it extends usually from the trachea down to the tissue proper of the lungs, involving the whole mucous membrane of the large and small bronchial tubes. Its chief peculiarity is its tendency to pass into lobular pneumonia; indeed, if the bronchitis continue for a considerable length of time, this affection is almost certain to supervene. Secretion takes place very early, and consequently the dry rhonchi do not make their appearance alone, or they may continue for so short a time as to escape observation: this is another point in which it differs from the affection as it occurs in adults. As the smaller bronchial tubes are usually affected, we almost always find the subcrepitant rhonchus, which can be heard at all times; for children do not expectorate, but throw off the accumulated secretion by an effort of vomiting, or simply swallow it. The chest usually gives a clear sound on percussion, though it is sometimes rendered dull by the accumulation of mucus in the small tubes, and of blood in the tissue of the lungs. These signs are more marked, and more early developed in the right lung, which is more commonly the seat of pneumonia, than the left.

Children affected with bronchitis are usually very irritable, and have a great dislike to the physical examination. It requires, however, so short a time to perform this, that I scarcely ever omit it; the ear may be placed to the chest, and the rhonchus may be heard during the inspiration preceding the effort of crying. The moist rhonchi are generally more marked and persistent in children than in adults; they, however, will generally disappear for a time, after a violent effort of vomiting, by which the bronchial tubes are of course unloaded.

Besides the physical signs, we meet with a loose cough, orthopnœa, and flushing of the face; the redness, instead of being circumscribed as in the case of adults, extends over the whole face, and is of a purplish color, which is to be ascribed to the imperfect aeration of the blood. There is also at times great febrile excitement, with cerebral symptoms.

The treatment is also modified by the age. In bronchitis attacking adults, bleeding from the arm is, in some cases, the best means of depletion, while in children its advantages are always very questionable, and it may sometimes be positively injurious. Local depletion is decidedly preferable. Children, who have passed the age of two years, may be treated by general bleeding; but before this age, it should almost never be practiced for the cure of bronchitis. I have very rarely found it necessary to bleed an infant suffering with disease of the chest; indeed, in these affections I only bleed as an exception.

Cups may be applied with facility to a child three or four years of age—that is, one to each side of the chest. Sometimes there is no difficulty in cupping those who are considerably younger. Of course the scarificator should have its lancets fixed at a very short depth.

Leeching may be substituted for cupping, in the case of some children, but we should be very cautious not to abstract a large quantity of blood, as may readily be done if the European leech is applied. I must, however, confess that I comparatively rarely apply this remedy to children affected with bronchitis.

Sometimes the application of a blister for an hour or two will answer well; or mild sinapisms may be placed upon the chest or ankles; the latter are generally best made for children by moist-

ening a piece of bread in hot vinegar, and dusting it with a little mustard.

Nauseating expectorants are the remedies which have been found most generally beneficial in these affections. Among these, ipecacuanha holds the first rank; this is given in the form of a wine, or, what is still better, a sirup. When much mucus is present in the tubes it is sometimes useful to give it in doses sufficient to produce vomiting, thus favoring the tendency which already exists; by this act the mucus is thrown off, and it is the only way in which children can rid themselves of it, as they cannot expectorate: the discharge from the lungs is with them immediately swallowed. It is generally, however, used in small doses, which act upon the skin and other secretions without producing much nausea.

Antimonial wine is also used in the treatment of this affection, but I prefer the wine of ipecacuanha in the greater number of cases. The former is a more powerful remedy, and in very severe cases more reliance can be placed on it, but it is, on the other hand, more liable to induce inflammation of the mucous membrane of the stomach and intestines. Squills is also a remedy in common use in the pectoral affections of children, and is usually kept in families in the form of sirup.

Another very important point in the management of this affection is, that the child be not suffered to remain too long on its back, as this position promotes the development of lobular pneumonia, in consequence of the mucus gravitating to the inferior portion and accumulating in the small tubes, which renders aeration imperfect, and thus favors, if it does not produce, the congestion of the lung which ends in pneumonia. The child should not be allowed to lie on its back for a longer period than two hours. This direction may appear to be trivial, but it is of much importance, for I have known death to occur from a neglect of this precaution.

In the Children's Hospital at Paris, I have many times observed lobular pneumonia to occur after the bronchitis of children, simply because the little patients were allowed to remain on their backs during the greater part of the day. This, however, was six-and-twenty years ago. I have no doubt that this important precaution is now properly attended to.

Bronchitis of old men. The bronchitis from which those advanced in age so frequently suffer is an affection presenting much variety of form. In the first place, it varies as regards the affected portion of the bronchial tubes. It sometimes attacks the smaller tubes, and then it simulates pneumonia. Indeed, it is often called peripneumonia notha.

The rhonchi observed in old men laboring under bronchitis are in the first place often a loud and decided sonorous rhonchus, coupled with abundant mucous and subcrepitant rhonchi. These are usually more liquid than in younger persons, because the secretion is less viscid, and at the same time more abundant. The patient suffers excessively from dyspnœa, which is much worse when he already labors under emphysema, or any other disease of the respiratory organs, which of itself occasions a difficulty of breathing. The treatment of this affection varies according to the condition of the individual attacked by it, and the form of the disease which it assumes. If the patient be robust, and we are called early, we will find it advantageous to resort to pretty free depletion from the arm. Great caution, however, is necessary in the use of this remedy after the disease has advanced to a certain point. As a general rule, I think it best to abstain from blood-letting, except at the earlier periods of the disease. When secretion has taken place, and the patient is reduced in flesh and strength, the bleeding often causes dyspnœa by preventing expectoration.

Vegetable emetics, in small doses, and expectorants, especially those of a stimulating nature, are the most valuable remedies in these cases; and in this disease we again find that the senega is one of the best expectorants of its class. If the patient be weak and debilitated, some carbonate of ammonia must be added to it; but the balsam of copaiba does not answer so well in this variety. If I were to select the diseases in which carbonate of ammonia is decidedly useful, I should place the bronchitis of old men and feeble subjects at the head of the list. The ammonia keeps up the strength of the patient, and promotes the natural process of cure; that is, evacuation from the bronchial mucous membrane. It therefore acts directly upon the affected part; blisters and sinapisms exercise a much more indirect influence upon

it, and do good rather as revulsives in removing the inflammation, and as stimulants to the nervous system, than as direct curative agents.

In some cases of bronchitis there is a viscid secretion with deposit of lymph, which causes great dyspnœa on account of the formation of a membrane in the tubes; sometimes this membrane has a tubular form, and these tubes have been ridiculously termed bronchial polypi. This formation I have observed more frequently in old persons than in children. It causes dyspnœa by protecting the mucous membrane of the tubes from the contact of the air, and by obstructing the passage into the air-cells. The lymph is detected by its presence in the expectoration, as well as by the orthopnœa. Emetics and expectorants, as those of a nauseant or stimulant kind, are appropriate to this disease, according as inflammation is present or not; but mercurials, which are the most efficient of all known medicines in preventing the formation of lymph, are sometimes required, if the affection be highly inflammatory.

Chronic bronchitis. I have still to speak of the chronic and specific varieties of bronchitis, and shall commence with the chronic.

Chronic inflammation of the serous and mucous membranes may originate in two ways: First, it may assume the form which it retains in chronic inflammation from its commencement; secondly, it may follow acute inflammation, which frequently passes into the chronic form. The latter is the more common in the case of bronchitis.

Chronic bronchitis presents several varieties: *the common chronic mucous catarrh; chronic catarrh, with a thin glairy secretion;* and the *dry catarrh*, with thickening of the bronchial mucous membrane. There is another form described by some authors, viz., the *pituitary;* but this is very rarely met with so strongly characterized as to be distinguished from the second variety, or chronic catarrh with a glairy secretion, and therefore it may be considered as a mere modification of it.

The first variety, or the common chronic mucous catarrh, is the most common. It is characterized by a secretion of white or yellowish mucus, sometimes puriform, generally in irregular shreds,

and but rarely molded to the form of the tubes. It consists of mucus rendered albuminous or purulent in the progress of the inflammation. The febrile excitement in this affection is various, being sometimes very decided, but in a majority of cases comparatively mild. It is usually greater at night than during the day. The appetite, and other constitutional symptoms, vary very much.

The diagnosis is based upon the presence of certain physical and functional symptoms, and the absence of other physical signs which are found in analogous affections of the chest. The positive signs are, in the first place, the rhonchi; these are chiefly of the moist variety, and vary very much, the subcrepitant being heard at one time, and the coarse mucous rhonchus at another. The respiration is sometimes loud and rough, at other times feeble; the latter state is much more common. These are the positive signs. Our diagnosis is rendered certain by the absence of signs which other diseases of the chest always present. Thus it is distinguished from phthisis by the absence of flatness at the summit of the lungs (as we almost always find is the case in this affection) and of the bronchial or cavernous respiration. Although the dullness is often absent in the commencement of the affection, we not unfrequently find it to supervene after it has continued a certain time, as chronic bronchitis may often become a precursor of phthisis.

This change in the condition of the lungs is shown by constitutional as well as local signs. An increase of febrile excitement takes place, and the patient becomes more emaciated. Emaciation sometimes occurs without the supervention of phthisis, from the alimentary canal being involved, and from the febrile excitement; but this is of more rare occurrence, and we do not often meet in our practice with cases in which the diagnosis is rendered obscure on this account. After the tuberculous disease has taken place, it is exceedingly rare that the patient recovers, as this constitutes one of the worst varieties of phthisis. Sometimes the change that is about to take place seems to be indicated by the constitutional signs before the development of tubercles has occurred, by the febrile excitement, by the other symptoms being decidedly increased, and by a change in the complexion and

countenance. This is a time when a correct diagnosis is of very great importance, as a proper plan of treatment may retard or prevent the development of a disease which is almost always fatal.

Treatment. The treatment of this form of chronic bronchitis is somewhat similar to that pursued in the acute varieties. General blood-letting is not often indicated; but the abstraction of small quantities of blood, by means of cups, often repeated, produces very good results: the cups are usually applied in the axilla, between the scapulæ and under the clavicles. If the disease at any time assumes a more acute form, general bleeding may sometimes come in very well. Leeches are sometimes used, but cups are preferable on several accounts; they produce a greater degree of irritation, without so great a loss of blood, and are cheaper and more convenient.

Counter-irritants to the chest are very good adjuvants. These are numerous, and various in the degree of irritation they produce. I generally prefer the milder ones, such as Burgundy pitch, croton oil, etc.; which being applied over a large surface often produce, I think, a better effect than blisters and tartarized antimony, which must be limited to a comparatively small portion of the chest. Liniments of a stimulating character have been much recommended; these consist of ammoniacal and terebinthinate mixtures. The noted empiric, St. John Long, was in the habit of treating thoracic diseases solely by applications of this character. Flannel worn next the skin, and woolen stockings on the feet, are essential as adjuvants.

As internal remedies, the stimulant expectorants should be used, except in those cases in which the disease approaches the acute form, when the antiphlogistic and sedative medicines are much more effectual. These are ipecacuanha, tartarized antimony, etc. Of these I prefer the ipecacuanha, as it is much milder in its action, and more easily borne than tartar êmetic, which, after it has been employed for a few days, is apt to affect the mucous membrane of the stomach and intestines.

In the more chronic cases the balsamic expectorants are employed with great advantage. Of these the balsam of copaiba is the most efficient, but it is a very disagreeable remedy, and cannot be taken by persons who are at all dyspeptic. The success

in the employment of the remedy with patients of this class depends very much upon our mode of administering it.

We should commence with half a drachm of the balsam in twenty-four hours, which quantity is to be gradually increased up to one or two drachms in the same period. If it produces much purging, after administering it for some days, its use must be stopped, as this is an evidence that it has made an impression on the system, or we may sometimes arrest this by adding a few drops of laudanum to the mixture containing it. This remedy is only to be resorted to when others have proved ineffectual, as it is exceedingly disagreeable to the patient.

The new mode of giving balsam of copaiba, in capsules, is one much to be preferred in cases of chronic bronchitis, as it produces less distress to the stomach, and acts equally well as a stimulating expectorant. One of these capsules may be given about three times a day; it should be taken after a meal, so as not to interfere with the appetite.

There are other remedies of a milder nature, which can be taken with more facility; they are generally given in the form of sirups or lozenges. Most persons prefer the former, as they have been accustomed to the use of cough mixtures, which are generally in the form of sirup. Sirup of senega is one of the best in the very chronic cases; sirup of ipecacuanha is also frequently used, and many prefer a combination of the two, which answers a very good purpose. I often use a combination of senega and Prunus Virginiana, or senega and sanguinaria, but more frequently the former.

The wine of ipecac., given in doses of ten drops each, with half a drachm of tincture of lobelia, and a few drops of paregoric, three or four times a day, is also serviceable, unless the stomach should be very irritable.

Gum ammoniac is a remedy much used by some physicians, and in its action nearly resembles the balsam of copaiba. Assafœtida is also an excellent expectorant, but its taste is objectionable to many adults; it may be given in the form of lac assafœtidæ. For children it is peculiarly adapted.

Opium, as a remedy in chronic bronchitis, has many advocates, and it is certainly very beneficial in some cases; but I am very

cautious as regards its employment in those affections for the relief of which a secretion is necessary. I only use it as a means of procuring sleep when the cough is troublesome at night, especially when there is much irritatión about the trachea and larynx.

If we prefer the form of lozenges, one of the best prescriptions will be that of ipecacuanha made up with the proper materials into lozenges, each containing from half a grain to a grain of ipecacuanha, to which a small portion of morphine may be added if necessary.

The next point in the treatment is the hygienic condition under which the patient should be placed. And here the question occurs, should the patient be confined to the house or not? I would not, as a general rule, enjoin this upon him; but where there is a certain degree of acuteness in the symptoms I think it necessary. In other cases he would lose much by keeping within doors in mild and pleasant weather, although during the cool, damp weather which is common in the spring, he should by no means expose himself. We should therefore direct our patient to take gentle exercise in the open air in good weather, unless he should find it to disagree with him.

A sea voyage to a warmer climate will often remove a bronchitis of long standing; but it is often very inconvenient for the patient, and in many cases it is not in his power to try it. In proportion as the disease becomes more and more chronic, the patient may increase the amount of exercise, and endeavor to stimulate the muscles and the skin, and thus produce a general but mild revulsion from the interior organs. This treatment is not only of great service in removing the bronchitis, but it is the best means of obviating the danger of pulmonary phthisis. The rules as to clothing and warmth are obvious enough; the great secret of the treatment consists in diffusing the action and nutrition throughout the muscular and tegumentary tissues, and thus giving to the bronchial mucous membrane an opportunity of regaining its normal condition. The medicinal treatment is more complex; but if we separate it from the hygienic management, it will be found to be less efficacious than the latter.

Annual catarrh or hay asthma. The second variety of chronic bronchitis is, in some respects, a most interesting disease. It is

distinguished from the preceding by several peculiarities. It does not usually follow the acute affection, but commences with its peculiar characteristics. It generally occurs at irregular periods, but in many individuals it takes place at regular seasons; in this climate usually at the close of the summer, about the month of August. It is quite frequent too in Great Britain.

The local signs of this affection consist of the various rhonchi, both dry and moist, the latter being found usually at the lower part of the chest, the former in the upper portion; there is, however, a predominance of the moist rhonchi over the dry, and of the sibilant and subcrepitant over the coarser varieties, as the smaller tubes are more affected than the larger. Sometimes all the rhonchi are heard at once, and produce a singular confusion of sounds, to which Laennec has applied the term *omnium avium cantus.* In some cases the air-cells are dilated, which renders the respiration feeble, and gives rise to much dyspnœa, resembling asthma, and indeed it may be set down as one of the varieties of this disease. The dyspnœa complicating the affection, however, more frequently arises from thickening of the tubes preventing the passage of the air into the vesicles. These attacks of dyspnœa are sometimes permanent, sometimes transitory. The fever attending this variety of bronchitis is very slight, and there is very little emaciation.

When this disorder assumes a periodical character, and occurs at a particular time of the year, it lasts several weeks, and in general cannot be cut short by treatment. The duration of this variety of the disease is less than that which occurs at irregular intervals, and it resembles in many respects the more ordinary forms of acute catarrh, but is much more intractable.

If this disorder becomes, as it were, settled upon an individual, it is sure to reappear every year, and nearly if not quite on the same day. If the patient should, however, change his climate, or even his locality, or take a short sea voyage, he may hope to get rid of it, at least for a time, for the disease is in some way connected with the change of the seasons, not usually appearing at the hottest part of the summer, but at that period when the nights become longer and the atmosphere is more damp.

It varies also in different years; sometimes the patient escapes with but a short and slight attack; at other times the inflammation is so severe as to approach very nearly to a pneumonia. I have never, however, seen it pass into true inflammation of the substance of the lungs. In the most severe cases, the patient suffers more from headache, and from the degree of feverishness which he complains of, than he does from the cough, which, after he becomes in time accustomed to it, annoys him less than it would do in the case of a single attack.

I do not regard this annual catarrh as attended with any actual danger, nor as a very frequent cause of pulmonary consumption, although it causes a vast deal of suffering and inconvenience to the patient.

The period of life at which it occurs varies greatly, from childhood to quite advanced age. Sometimes it will disappear, after reappearing for a number of years; in other cases it becomes so fixed upon the patient that it assumes, as it were, a part of his being, and he cannot possibly get rid of it.

Treatment. Bleeding, in a majority of cases, is not well borne; but when the symptoms are very acute, it may be prescribed with advantage. Cupping is generally preferable to general bleeding, in the limited number of cases in which either is required. The remedies to be used are those which are calculated to relieve the dyspnœa. These are principally the nauseating expectorants, of which I think lobelia to be decidedly the best, given so as to produce slight nausea; it thus favors secretion and expectoration. Balsam of copaiba is also a very good remedy; but the same objections apply here as in the other forms of bronchitis.

The best remedies I consider to be the tincture of lobelia, as already mentioned, sometimes conjoined with the sirup of squills, and occasionally with a small portion of paregoric. This combination relieves the cough, and to a certain degree the dyspnœa. It is also necessary for the patient to avoid exposure to a draught of cold air, particularly when he is perspiring freely, a slight check to the perspiration increasing the dyspnœa.

The bowels should be attended to. I always give my patients a little laxative medicine, such as magnesia, or a Seidlitz powder,

every two or three days, so as to keep the bowels as regularly open as possible.

The appetite is so much diminished by the fever that it is unnecessary to say much as regards the diet; if, however, a patient should retain his full power of digestion and desire for food, I would recommend him to eat rather less stimulating articles than usual.

In the periodical form of the affection, after the paroxysm has commenced, no treatment has yet succeeded in cutting it short. There is, however, one point which demands our attention, viz., the prevention of the occurrence of the disease. In a number of cases for which I prescribed cold affusions and the exhibition of quinine, previously to the attack, the disease appeared much later than usual, was milder in its character, and its duration was much less.

In the treatment of this disease, the quinine should be commenced not later than the month of June, so as to anticipate the attack in July or August. The dose is two grains two or three times a day. This remedy does not seem to act strictly as an antiparoxysmal in these cases, although its agency may be in a certain degree of that character. It increases the general health of the patient, and his powers of resistance to the disease, thus proving an efficacious agent.

Dry catarrh. The third variety is perhaps as frequent as either of the others, and is, by a strange contradiction in terms, called *dry catarrh*, because there is little or no expectoration—differing in this respect from the other varieties. The prominent lesion in this form of bronchitis is a thickening of the mucous membrane. This, though rendered evident by the local signs, is not always found after death: in this respect it is analogous to other congestions of the mucous membranes. It is attended with very little febrile excitement; and the functions of the alimentary canal are but slightly if at all impaired. The cough is short and dry, thus differing from the cough which attends the other varieties, in which it is most loose. The chest is sonorous throughout, and in some cases preternaturally so, on account of the emphysema, which is a frequent attendant. The respiration is generally feeble, and sometimes a rough, rustling sound is

heard, arising from friction of the air-cells against the pleura. The dry rhonchi are usually heard, though not in all cases, as the thickening must proceed to a certain point in order to produce them; they, of course, vary according to the particular part of the bronchial tube which is affected. But it generally happens that the sibilant rhonchus is chiefly confined to the anterior part of the chest, and the sonorous rhonchus to the neighborhood of the larger tubes. Besides emphysema, there is another complication which is frequently met with, and which like it, is produced by the violent efforts made in coughing,—I allude to hypertrophy and dilatation of the heart. These three affections frequently coincide; and the heart disease, the dry catarrh, and emphysema, form a triple lesion.

The duration of this variety of chronic bronchitis is greater than that of the other two. It continues to an indefinite period —the patient often laboring under it for several years, unless some acute affection of the lungs should supervene, which is then rendered more grave by the previous existence of the dry catarrh. When, for instance, pneumonia attacks a person who is affected with dry catarrh, the dyspnœa which under ordinary circumstances attends the acute affection is rendered more severe by the existence of the chronic; this, of course, renders our prognosis much more unfavorable than it is when the disease is not complicated with an acute inflammation, or when the dyspnœa is not severe.

This variety is increased in severity during the latter months of winter, and in the spring; the patient being liable to attacks of acute bronchitis as a complication. In that way it may indirectly prove a cause of death, by increasing the severity of other affections, although of itself it is never fatal.

Treatment. Very little advantage results, I think, from the employment of medicines in this variety of chronic bronchitis. It is, however, of importance to attend to the hygienic condition of the patient. His clothing should be warm, and his chest and extremities protected by flannel; and he should not expose himself in damp and inclement weather, while he should take exercise when the weather is dry and pleasant. The patient, however, sometimes insists upon having medicine, and it is as well to

gratify him in this respect. The balsams and turpentines have been much used; also alkalies, which are highly recommended by Laennec.

I have not spoken of the use of mercurials in the treatment of chronic bronchitis. They have been used from time to time, but the results have not been such as, in my mind, to warrant their employment.

The *pituitary catarrh* of Laennec is another variety of chronic bronchitis, which is, however, not at all common. The peculiarity in its symptoms depends upon the abundant secretion, which furnishes a very copious expectoration; the quantity of this may amount to a quart or two in the twenty-four hours, and almost always exceeds a pint. The patient is attacked with frequent fits of coughing, which are followed by the expectoration of a large quantity of a thin, glairy mucus, either white or semi-transparent.

The disease is unattended with fever, the patient, however, suffering very much from the violence of the cough, and the abundance of the expectoration following it. There is, however, not much emaciation, or other sign of great disturbance of the system.

This disease is not, as a general thing, capable of being arrested; it may, however, be moderated by an avoidance of exposure to the causes of bronchitis, and by placing the patient in some degree upon the treatment already recommended for ordinary bronchitis.

There is an affection which resembles very much the dry catarrh —that is, the cough which occurs in some cases of dyspepsia; it is usually dry, and sometimes attended with rhonchi, although in general they are not heard. The diagnosis here depends upon our knowledge of the previous affection of the stomach. In other cases, however, a bronchitis previously existing is aggravated by the occurrence of gastric disorder; here the priority of symptoms must be your guide. We can generally succeed in arresting this cough by the use of tonics, alkalies, and other remedies adapted to the state of the stomach.

Chronic bronchitis may arise from a variety of causes, as a fever, an acute attack of disease of the lungs, etc. It is fre-

quently found coexisting with tuberculous phthisis, which may either have preceded or followed it; and it may follow any other disease of the lungs, or it may be the cause of such affection. Indeed, we seldom meet with a disease of the parenchyma of the lungs unaccompanied by bronchitis, which we might naturally suppose would be the case, since the bronchial tubes constitute so large a portion of the respiratory organs. The disease receives the name of *bronchitis* when the affection is confined to the tubes; but when the parenchyma is attacked, the bronchitis is looked upon as a mere complication of the more serious affections, and the designation of the disease accords with the principal lesion. This rule should be adhered to, otherwise you will confound together many different affections, and may include phthisis, laryngitis, and pneumonia, under the common designation of bronchitis.

Secondary bronchitis. Although acute bronchitis is in many cases an idiopathic affection, it also occurs frequently as a complication of other diseases. Almost no acute disease attended with fever is entirely exempt from it; and as a general rule the degree of fever is proportioned to the frequency and severity of the secondary bronchitis. It is thus an almost invariable attendant upon measles, typhoid fever, and in fact many of the exanthematous diseases. The secondary inflammation is most frequent at the same season of the year as the primary bronchitis; that is, in the early spring, and in the winter months, when febrile diseases are peculiarly liable to this complication. There are also many chronic diseases which singularly favor the development of acute bronchitis; these are diseases of the heart and of the lungs. I have already alluded to the connection of this disease with tubercles; this is the variety most difficult of recognition, but scarcely more so than the acute bronchitis which occurs during the course of pneumonia, or in emphysema. In these cases the distress and difficulty of respiration are much greater than in the simple form of the disease.

Chronic bronchitis is also of frequent occurrence as a complication of different diseases; of these, one of the most common is hypertrophy or valvular disease of the heart. In these cases the bronchitis arises to a great degree from the impediment to the

circulation of the blood through the lungs, which of course produces congestion. The chronic form of bronchitis is also subsequent to phthisis and to emphysema.

The treatment of this variety of the disease is similar to that of the acute or chronic idiopathic bronchitis, and consists in the use of depletion, stimulants, expectorants, and diaphoretics. After the secretion from the mucous membrane has set in, local depletion may be used according to the necessity of the case. Cups are more beneficial than leeches, as they produce greater irritation with a smaller abstraction of blood; they are generally applied between the scapulæ. Stimulants applied externally often produce a good effect; sinapisms and other remedies of this kind are usually placed upon the anterior portion of the thorax. They act as counter-irritants.

PECULIAR VARIETIES.

Besides the modifications of bronchitis which depend upon the duration of the disease, and the age or other peculiarities of the individual, there are other varieties which are specific in their character, and depend upon a peculiar condition of the system, produced by a constitutional disorder.

Of these varieties, one of the most frequent is *pertussis*, or *hooping-cough*. This is an affection of the nervous system, accompanied by bronchitis, in which sometimes the one, sometimes the other predominates; the affection of the nervous system being in some cases very severe, with but little cough, whereas the cough is frequently very bad, with comparatively slight nervous symptoms. We almost always meet with this disease in children, though adults are occasionally attacked by it. It is a self-limited disease, and therefore cannot be cut short by treatment, although its complications may be removed or palliated. Though the inflammation of the bronchial tubes is merely the local part of the disorder, yet it is in one sense the most important, for when the disease proves fatal, patients generally die of the bronchitis and its immediate effects. The secretion from the mucous membrane is much greater than in ordinary varieties of bronchitis; and in children it tends constantly to accumulate in the inferior parts of

the tubes: they are in this way gradually enlarged until permanent dilatation results. The thickening and congestion of the mucous membrane do not differ from the same alterations in ordinary bronchitis. When a fatal termination occurs, it generally arises from the feebleness of the patient, and a consequent inability to expectorate, or, as is the case with children, to discharge the secretions by vomiting. The parenchyma of the lungs may in this variety become congested and inflamed, and produce a pneumonia which may prove fatal.

In a certain proportion of fatal cases of hooping-cough, it will be found that tubercular disease of the lungs has supervened; although this is a less frequent cause of death than pneumonia.

The principal sign of this disease is the peculiar hooping character of the inspiration succeeding a cough: this is preceded, and in a great degree caused, by the forcible expulsion of air from the chest, in fits of coughing, and it sometimes occurs in other forms of bronchitis, which, however, do not often possess the paroxysmal character of pertussis.

These fits of coughing sometimes occur suddenly, without the influence of any assignable cause. At other times they are brought about by some mental emotion, or by any other cause which disturbs the child. The paroxysms recur at very different times; in some cases they return every few minutes, but the interval is generally much longer. When they take place, the countenance of the patient becomes flushed, occasionally almost to a purple hue, the color being of course more marked at the moment of the paroxysm. There is also frequently a considerable degree of fever in the early stages of the disease, together with loss of appetite and difficulty of digestion, which is somewhat increased by the frequent fits of vomiting which follow those of coughing.

In addition to the cough we meet with the rhonchi, both dry and moist, sometimes with a gurgling caused by the collection of fluid in the dilated bronchi. That is, the mucous, the subcrepitant and the sonorous rhonchi, are generally heard at one and the same time. The cough usually lasts for several weeks; it then declines by degrees, and the rhonchi disappear. It is gradual in its attacks, being at first slight, and then becoming violent. It comes on in paroxysms, of which, in mild cases, there are usually

five or six during the day, the patient being free from cough in the interval. In severe cases the number of paroxysms is much greater. They sometimes occur as often as once an hour, and occasionally there is only an interval of a few minutes. In such cases the patient generally dies of exhaustion. The secretion in the bronchial tubes consists of thick, glairy mucus; when it has continued for a long time it often contains a small portion of pus, intermixed with blood. In some cases blood is effused, and a partial hæmoptysis occurs. The secretion is usually thrown off by vomiting, especially in young children who cannot expectorate. The appearance of the face in this disease is peculiar, being of a bluish color, accompanied by puffing of the eyelids. This is the effect of the violent efforts made in coughing, and the congestion consequent upon them. It is in some degree a measure of the severity of the affection.

When fever occurs it indicates the existence of inflammation of the lungs, and when high it is a symptom of much gravity. When the development of tubercles takes place toward the close of the disease the fever continues, with a quick, irritable pulse. It is usually the miliary form of tubercles which occurs under these circumstances, and is almost always fatal.

The *diagnosis* is pretty clear after the second week; the paroxysmal character of the cough, with its hooping inspiration, its complete intermission, and the recurrence of the paroxysm during any disturbance of the mind, are sufficient to characterize it.

The *prognosis* is generally favorable in the simple forms of the disease, but becomes less so in proportion to the severity of the complications.

Treatment. As the disease cannot, as a general rule, be arrested, we should palliate its symptoms, and assist nature in the means which she has pointed out for its relief; we should therefore promote the secretion in the tubes, and favor its removal. For this object we should employ mild vegetable emetics, which tend to bring about both these ends. They should be given once or twice a day for a week or two. In this affection there is always a disposition to vomit; and as this action, brought on by artificial means, is milder than when it occurs spontaneously, emetics afford

very great relief. After this treatment has been continued for the time above specified, we should make use of remedies whose action is slower but analogous to that of emetics, for this is the means pointed out by nature for the cure of the disease; and it is a maxim in therapeutics that when a secretion is intended by nature to remove any diseased state of the economy we should favor or moderate it, and not arrest it.

Ipecacuanha, in the usual expectorant doses, may be used for this purpose, and answers very well; but one of the best remedies in this affection is assafœtida, as it favors expectoration, and also controls the disorder of the nervous system, which constitutes so large a part of the disease. It may be given to children of eight or ten years, in doses of two or three grains, increased to four or five, several times daily. However, it cannot always be given internally, as it is so repulsive to the senses; applied externally in the form of a plaster it acts very well, producing an impression on the nervous system, and moderating the paroxysms. Ammoniac, galbanum, etc. are used in the same manner. Revulsives to the chest are useful, but not always necessary; when required, I prefer sinapisms to blisters or moxas. There is another remedy which is much more powerful than these—that is, the extract of belladonna; this must of course be used in very minute doses. Still, we cannot be too cautious in the administration of this medicine, which is certainly always attended with some risk. The success which attends its administration in hooping-cough is stated to be greater than that of any other remedy.

The clothing should be warm, and flannel should always be worn around the chest.

The complications are various affections of the lungs, which when very acute are to be treated by general and local blood-letting, and other remedies required in the affections occurring idiopathically. Phthisis occurs as a sequela of this disease, and does not require medication; it is best treated by a change of air, which is advantageous in the declining stages of all severe cases of pertussis.

As pertussis rarely occurs with adults, we are apt to make an incorrect diagnosis when it does thus occur; this should be borne

in mind, as we might confound it with a variety of bronchitis resembling pertussis, which is exceedingly difficult to get rid of. Ordinary bronchitis may be complicated with nervous spasms; but the disease should not be confounded with pertussis, unless the spasms are disproportioned to the bronchial affection. This constitutes the peculiarity of this disease, and gives to it a mysterious difference between it and other varieties of bronchial inflammation.

This disease occurs chiefly in young women of very nervous temperament, especially in those whose menstrual functions are somewhat disordered. It is therefore very analagous to hysteria, and in fact is often nothing more than a modification of that disease. On auscultation, the respiration is found to be perfectly pure in nearly every case, although sometimes it is complicated with mucous or sonorous rhonchus, which result from ordinary bronchitis added to the original affection.

The fits of coughing are exceedingly violent, and at times simulate hooping-cough so nearly that it is difficult to distinguish between the two affections; but there is very little mucous expectoration, and the disease is usually so connected with other disturbance of the nervous system that there can be little real ground for hesitation in the diagnosis. The disorder is not a serious one, never endangering the patient's life.

The treatment consists in the use of tonics, such as iron combined with quinine, with remedies calculated to relieve the disturbance of the nervous system. These are valerian in the form of fluid extract, which may be given in the dose of a teaspoonful two or three times a day, and the assafœtida mixture. Opiates should be given with great caution, from the danger to which nervous patients are always exposed of becoming inordinately fond of it. Sea-bathing, or when this is difficult to be attained, sponging with salt and water, or shower baths, all constitute useful remedies. Counter-irritants, such as blisters applied to the back of the neck, sinapisms, and the like, are also occasionally of service. In some cases the disease resists these means unless they are conjoined with traveling or an entire change of scene.

The diet should be nutritious but simple; and the mind of the patient, who is often considerably alarmed by the violence of the

paroxysms of coughing, should of course be set at ease as to the certainty of ultimate recovery.

Bronchitis dependent upon a constitutional taint. There are certain cases of bronchitis which depend on a particular diathesis, or a peculiar condition of the system, induced by a specific affection; to this class belong syphilitic and scrofulous bronchitis. But the syphilitic variety is singularly similar to phthisis in the emaciation and other constitutional symptoms; so much so that the deterioration of health is such as to end in phthisis. The scrofulous bronchitis is attended with a very abundant secretion of a thick, glairy mucus, and is in most cases complicated with an inflammation of the upper portion of the respiratory tubes, so that the nasal cavities are sometimes more affected than the bronchi; it must be treated with remedies calculated to correct the morbid state of the system, such as mercury, iodine, sarsaparilla, for the syphilitic variety: iodine, iodide of iron, and other chalybeates, may be used in the scrofulous varieties of the disease, besides resorting to local remedies.

In the latter class of cases the patient should also be placed upon a good nutritious diet, in addition to mineral and vegetable tonics. A residence during the summer in an elevated, mountainous situation, together with abundant exercise in the open air, is also indispensable. During the intense heats of summer, the patient may even be benefited by a visit to the sea-side; but this remedy should always be used with caution in this disorder; it is always injurious unless the temperature be exceedingly warm.

CHAPTER VIII.

DILATATION OF THE BRONCHIAL TUBES.

THERE are two lesions of the bronchi, arising from long-continued bronchitis, which differ very widely, however, in their physical condition, viz., dilatation and contraction of the bronchial tubes. The former of these lesions is by far the more important, and also the more frequent. It prevails in proportion to the number of cases of long-continued chronic bronchitis, with abundant secretions. Acute bronchitis will occasionally produce the same dilatation, provided the mucus be copious, and be expectorated with difficulty after violent efforts of coughing; hence it is not infrequent in pertussis, which is about the only disease of children that gives rise to this lesion.

As dilatation of the bronchial tubes is a mere lesion, which is produced by diseased action, but is in itself of little importance, it must necessarily require less attention than the diseases of the lungs, properly so called: nevertheless, it may be readily confounded with these affections, and even if it were not liable to this chance of error, there would still remain sufficient reason for studying the symptoms of it. Lesions of this kind should never be confounded with the diseases which give rise to them; but they offer interesting points of relation, and require therefore some attention in order to recognize them, and to discover the best means of obviating the mischievous effects which necessarily arise from their occurrence.

Dilatation of the bronchi assumes several different forms; the most frequent is a uniform enlargement of several bronchi of a lobe, which, after branching off from the principal trunks, remain nearly of their original size, or even enlarge as they approach

the surface of the lung. This variety results very frequently from hooping-cough, and the spasmodic bronchitis which resembles it most nearly. The mucous membrane at the same time is thickened and loses its transparency.

The other varieties, which are less common, are merely partial dilatations in the course of a bronchial tube. There may be only one single enlargement, or several successive dilatations of a large bronchus, which afterwards recovers nearly its natural size. The enlarged portions are thus distinct cavities, and, physically speaking, present nearly the same peculiarities as the cavities which arise from the softening of tuberculous matter. There is, therefore, necessarily cavernous respiration and pectoriloquy, and the condensed pulmonary tissue which surrounds the enlargement may cause a decided dullness on percussion. The condensation of the tissue apparently arises from chronic inflammation, which causes a deposit of new matter in the pulmonary substance. The precise nature of this substance is not ascertained; but it is probably albuminous, like similar deposits in other parts of the body.

In the variety in which the bronchial tubes are generally dilated there is rarely cavernous respiration; for the air, in diffusing itself through the lung, does not, of course, present the sharp clear reverberation which is essential to the formation of cavernous respiration. Hence there is very little difference between the respiration in this variety of dilatation and that heard in the second stage of pneumonia, when the hepatization occurs around the larger tubes. But in dilatation of the bronchi, the bronchial rhonchi, as the mucous and subcrepitant, are much more frequent than in pneumonia; and the permanency of the signs in the former alteration, and their rapid changes in the latter, will prevent all danger of confounding the two lesions together.

The diagnosis between dilatation of the tubes and phthisis is much more difficult, as it depends not upon the physical signs, which differ but little in the two cases, but upon the progress of the general symptoms. If the symptoms be those of chronic catarrh—that is, if they are attended with severe cough and but slight emaciation, the disease is probably chronic bronchitis with distention of the bowels; but if the fever and emaciation be much more decided, the probabilities are of course greatly

in favor of phthisis. Practically speaking, the chances of error are very slight; for those cases of chronic cough in which the dilatation of the tubes is sufficiently great to simulate a tuberculous cavity are almost always connected with very general bronchitis, in which the signs of a general thickening and inflammation of the mucous membrane are very evident, and totally unlike those of a tuberculous disease.

There is, however, another variety in which it is impossible to discriminate accurately between these two affections, for the tuberculous disease then coincides with the dilatation of the tubes. In this case the dilated tubes either pass through the masses of tubercle which are deposited at the summit of the lungs, or they terminate as soon as they reach these masses. If the tubercles have advanced to the period of softening, the cavities which are thus produced often communicate directly with the enlarged bronchi, and form as it were a continuous tube. When the dilatation is connected with a cavity, it is often preceded by a deposit of tuberculous matter in the bronchus, which is in this way gradually enlarged, and remains dilated after the softening of its contents.

There is, of course, no peculiar treatment for the dilatation of the bronchi; it is strictly a lesion, not a disease, and being placed beyond the reach of the mechanical means of treatment which are adapted to remove an external alteration, it necessarily must remain with the patient. The object of the physician is to remove, as far as possible, the protracted bronchitis, which generally produces the dilatation. The lesion then ceases to give rise to much mischief, and even a partial cure may take place.

The only variety which I believe to be really curable is that which follows the hooping-cough of children. In most cases of this disease of any violence, some dilatation of the tubes does occur; and after its termination, they almost always contract again to their natural size. This is evident from the fact that but few cases of fatal hooping-cough are met with in which the tubes are not found enlarged; on the other hand, dilatation of the tubes is rarely met with in children who die of any other disorder, although they may have previously labored under severe attacks of hooping-cough.

CHAPTER IX.

EMPHYSEMA OF THE LUNGS—ANATOMICAL CHARACTERS—SYMPTOMS—DIAGNOSIS—PROGNOSIS—TREATMENT.

Anatomical characters. This is an alteration which is closely analogous to dilatation of the tubes. In fact, it is the same disease attacking a different part of the structure—that is, the terminating vesicles of the lungs. In their normal state, these cavities are very minute, but may still be discovered by a good eye; but when enlarged, their size may increase much beyond their natural dimensions, and they then very frequently attain the bigness of a small pea, and in some cases are even much larger. The vesicles as they enlarge at the same time become thickened in their parietes, and press upon those adjoining, of which some are atrophied, and others appear to form a direct connection with the distended ones. It is in this way that the very large sacs, of the size of a pigeon's or even a hen's egg, seem to originate, not from a single vesicle, but from the junction of a number of distinct ones, which have gradually broken into each other.

Many of the vesicles, during the progress of emphysema, of course disappear; that is, the increase in size of those which are enlarged causes a rupture of their parietes, and in that way destroys many of the smaller ones. Besides that, some of the vesicles which are not at first enlarged, become as it were atrophied in consequence of the pressure upon them by the neighboring ones, whose caliber is much increased. Thus the number of vesicles in an emphysematous lung is certainly much less than in one which remains healthy.

The tissue of the lung which is the seat of the emphysema becomes pale, and crackles under the pressure of the fingers like a piece of dried lung, the walls of the vesicles losing their elasti-

city, and becoming much more rigid. The size of the dilated part of the lung is necessarily increased; hence it presses upon the intercostal spaces, and can no longer be confined in its usual limits. As a necessary consequence of this increase, the walls of the chest are enlarged to an extent corresponding with the distended part of the lungs, so that they form a decided protuberance.

The quantity of blood contained in an emphysematous lung is rather less than natural in those portions of it which are the especial seat of the disease—that is, the anterior margin of it; but the posterior parts contain as much blood as usual, and sometimes become congested on account of the dyspnœa, which is a necessary attendant upon all severe cases of the disease. The congestion frequently passes into pneumonia, and cases which prove fatal for the most part terminate in this way.

The mucous membrane of the bronchial tubes is rarely perfectly healthy in emphysema, if it be of severe character. There are two forms of bronchitis which commonly complicate emphysema—the chronic and the acute. The former is a regular and almost necessary complication; the latter is often absent during nearly the whole course of the disease, but it is more apt to occur in patients laboring under this disorder than in those who are in the enjoyment of perfect health. When it takes place as a complication, the distress of the patient is vastly greater than in cases of simple bronchial inflammation.

The chronic bronchitis which so commonly attends emphysema is nearly always of the dry variety, or, as it is often termed, it is in fact the dry catarrh. In this case the membrane is permanently thickened to such a degree as to impede the passage of the air, and constantly react upon the disease itself. The bronchitis is then doubly connected with the emphysema, and may be regarded both as cause and effect; either of the disorders may occur first, and will be almost necessarily followed by the other. Chronic dry catarrh produces of itself sufficient dyspnœa to distend the air-cells, and favor the development of emphysema; while if the anatomical condition exists, either as the result of original structure, or of some peculiar cause, the slightest obstruction to the freedom of the respiratory function may cause a severe attack of

dyspnœa, and thickening of the bronchial membrane is then almost a necessary result.

Physical signs. The physical signs of emphysema are extremely well marked in severe cases; but, of course, there are many instances in which the alteration deviates so little from the normal standard as to render the signs of doubtful value. When there is much distention, the physical signs are all present, and may be referred to the three following heads: 1. Distention of the portion of the chest. 2. Clearness of sound on percussion. 3. Feebleness of respiratory murmur. These are the only regular or constant signs, but there are occasionally a number of others perceived. They are sibilant rhonchus, from the frequent complication of dry catarrh, in which this rhonchus is heard along the anterior margin of the lungs; and subcrepitant, or mucous rhonchus, at the posterior part of the lungs, when they are much congested, or the bronchial tubes are attacked with acute inflammation. There is another sign which is occasionally met with—the dry subcrepitant rhonchus, which is nothing but the slight rustling sound produced by the bubbles of air either forcing themselves into the cellular tissue and forming little bags which rub against the pleura, or the dilated vesicles themselves, which are sometimes sufficiently rigid to give rise to some friction and cause a sound.

1. *Dilatation of the chest.* This is necessarily most evident in those portions of the thorax where the dilatation of the vesicles is greatest; that is, at the anterior margin of the lungs. The anterior plane of the thorax is rounded, and gradually assumes a convex shape, the most prominent portion of it being near the margin of the sternum: the form of the dilated portion is generally oval, the long diameter of the oval corresponding to the axis of the body: but as the extent of the altered portion of the lung is very variable, the form of the chest differs extremely. The dilatation is more evident in the intercostal spaces than at the level of the ribs, which are but slightly thrown out from the general plane of the body. There is at times a general distention of the chest; the shoulders are then elevated and rounded, and the thorax approaches very nearly to the cylindrical form. This extreme distention takes place only in those who have been

long subject to emphysema, especially those who have inherited a predisposition to the disease. In speaking of the dilatation of the chest in emphysema, we must remember that it is moderate, and never attains the degree which we find in large pleuritic effusion, or in pneumothorax. Emphysema, besides, always attacks both lungs, although not to the same degree; whereas pneumothorax is, of course, limited to one lung.

2. *Resonance on percussion.* The anatomical condition of the lungs in emphysema necessarily admits more air into the lung—in fact, the tissue is permanently distended with air; and if percussion be made over the part, the sound is of course clearer than in a lung which is perfectly in the normal condition. This clearness is extremely great in thin persons who are affected with emphysema: if the patient be corpulent, and sufficiently advanced in life for the elasticity of the chest to be diminished, a moderate degree of emphysema does not render the percussion very sonorous. The clearness of sound is of course greatest at the spot where the dilatation is most perceptible; and when the chest is generally dilated, the percussion retains its character of great clearness throughout. The resonance in a few patients is sufficiently great to resemble a little that produced by pneumothorax, but it never has the tympanitic sound produced by the latter lesion.

3. *The feebleness of the respiratory murmur* is the third peculiarity of emphysema. The dilatation of the cells prevents a free circulation of air; they even remain permanently dilated when removed from the dead body. This immobility probably arises from the thickening of the walls of the vesicles, which always follows their permanent enlargement. The respiratory sound is not only enfeebled, but if the emphysema be extensive, it is apt to assume a peculiar rustling tone, which is probably in part produced by the motion in the vesicles themselves, and in part by their friction against the parietes of the chest.

This rustling sound of the vesicles, to which I have alluded, is not the dry subcrepitant rhonchus, but is a peculiar intonation, louder in some respects than the healthy respiration, although the sound of the dilatation of the vesicles is much less marked. The sound evidently arises from the passage of air into the dilated

vesicles, together with a slight contraction at the point of opening; that is, it may be considered a sound somewhat analogous in its cause to the sonorous rhonchus. But the sound itself has a different intonation, and is much less loud.

The dry subcrepitant rhonchus, already alluded to, is heard occasionally in emphysema. The spot at which it occurs is always the anterior portion of the lung. It is not always heard, however, probably owing to the fact that this sound is produced only in cases in which the dilatation of the vesicles is very great, and so situated as to rub against the walls of the chest. In that way the rhonchus is produced during both inspiration and expiration.

Symptoms. The functional symptoms of emphysema are less characteristic than the physical signs, but are always sufficiently marked to increase the certainty of the diagnosis,—sometimes to indicate of themselves the character of the disease. One of them is much more constant than any other—that is, the dyspnœa.

The other symptoms depend in a great degree upon the complication of chronic or acute bronchitis, which so often attends the disease; hence they vary according to the intensity of this affection. They are cough, expectoration of thick, pearly sputa, which are small in quantity, or of a large amount of thin, glairy, and transparent matter, which occurs in the paroxysms of the dyspnœa, or during the complications of acute catarrh. There is no fever or disturbance of other organs than the lungs or heart, which is necessarily connected with dyspnœa; when other affections occur, they may be set down as complications which may acquire additional severity from the pre-existence of the emphysema, but do not arise necessarily from it.

The dyspnœa is in part permanent, and in part comes on in paroxysms. The permanent dyspnœa is developed by any exercise which hurries the act of respiration, such as ascending a flight of stairs or a high hill, or indulging in any unwonted exertion. The subject of the disease then complains that he cannot take as much or as long-protracted exercise as other people; and this inability, if it be not accounted for by decided organic disease of the heart or lungs, is one of the best diagnostic characters of the lesion. It is very regularly proportioned to the extent and severity of the emphysema, and in slight cases may escape notice. The dyspnœa

which occurs in paroxysms is not frequent until the disease has become complicated with bronchitis, or, as is still more frequent, with a disease of the heart. In the latter case a disturbance of the circulation is frequently produced by slight causes, and then the paroxysms of difficulty of respiration become extremely severe and intense, until the patient is partially relieved by a free expectoration of glairy mucus from the bronchial membrane, or until he remains for a considerable time in a condition of perfect repose. If the patient be extremely corpulent, the frequency of the paroxysms is of course proportionally increased, and they become more and more severe as the disease continues longer, for the dilatation in the majority of cases tends to increase,—and each successive attack, by distending the vesicles, may act as a new exciting cause of a further enlargement of them.

Cough is not a necessary symptom of emphysema of the lungs, but it sometimes becomes a permanent one. That is, in cases in which bronchitis accompanies it, the cough occurs in paroxysms, and is exactly proportionate to the severity of the attendant bronchitis. There is sometimes, however, a slight hacking cough, which is almost voluntary, and which results from the difficulty which the patient feels in distending his lungs.

There is no expectoration peculiar to emphysema, except a little ordinary mucus thrown off from the tubes. There is, however, very often an abundant expectoration resulting, like the severe cough, from the accompanying bronchitis. The sputa are then glairy, white, contain a large quantity of air, and are quite abundant. Sometimes in violent paroxysms of the disease, there is a little streak of blood; this, however, is never abundant.

The countenance of the patient, even in ordinary cases of emphysema, sometimes assumes the purple tint which is generally set down as peculiar to diseases of the heart. These cases are, however, in fact very often examples of such a complication.

There is of course no fever or other general symptom peculiar to emphysema of the lungs, with the exception of those just mentioned.

Patients may be attacked with this disorder at any period of life; it is sometimes even congenital. But, as a general rule, it increases in frequency in proportion as patients advance in life.

Hence there are comparatively few old persons whose lungs are not to a certain degree emphysematous, the continued use of these organs having in fact distended the vesicles.

It must be obvious from the symptoms of emphysema, as above detailed, that it is to be looked upon in the majority of cases as a lesion rather than as a disease. That is, I believe that it is more frequently produced by dyspnœa than it is a cause of it; but when emphysema exists, if the function of the lungs be interfered with, great difficulty of respiration at once occurs. The converse of this is also true, that when the patient breathes with difficulty for a long while, from any disorder of the lungs, there must be more or less enlargement of the vesicles, particularly along their anterior margin.

Emphysema is also in many cases a lesion connected with other diseases. Thus if a patient be laboring under any disease of the heart, the circulation through the lungs is impeded, and emphysema will often follow as a consequence. The converse of this is also true; if a patient is laboring under emphysema, with its attendant symptoms, he is exceedingly apt to be taken with hypertrophy and dilatation of the heart. The blood is then impeded in its passage through the lungs, and of course forced back again upon the central organ of the circulation.

Diagnosis. The diagnosis of severe cases of emphysema is readily enough made, for the physical signs are then pathognomonic of the affection; but in slighter cases they are not always clearly enough developed to render the diagnosis quite certain. This is the case where there is little or no dilatation of the chest, but merely an increased resonance on percussion, and a diminished loudness of respiration. We are then obliged to resort to the diagnosis by way of exclusion; and if we find that no other disease which can account for the permanent dyspnœa exists, we should ascribe it to emphysema. When emphysema is complicated with another disease of the lungs, or with one of the heart which in itself is capable of producing a corresponding dyspnœa, it is difficult to ascertain the precise influence of the two affections. If the dyspnœa be excessive, emphysema alone is rarely capable of producing it; but if it be more moderate, the probable share of each affection is extremely difficult to ascertain.

Prognosis. The prognosis in this disease is favorable, so far as the chances of death are concerned, for a patient can scarcely die merely of emphysema. But, on the other hand, a complete recovery is hardly possible unless in very recent cases of the disease, when the distention of the air-cells has succeeded an acute disorder. In this case the lesion tends gradually to recovery, although the restoration is rarely perfect; for the constant dilatation to which the vesicles are subjected prevents them from resuming their natural size.

Treatment. The treatment of emphysema is in a great degree nugatory, so far as the removal of the lesion itself is concerned; but the paroxysms of dyspnœa may be checked, and the attacks of acute bronchitis relieved. The remedies most useful in checking the dyspnœa are sinapisms, applied between the shoulders to the dorsal spinal vertebræ, and the use of lobelia, in doses sufficient to excite slight nausea. If the tincture be used, the dose should be twenty or thirty drops every two or three hours: some patients, however, will bear or even require a much larger dose, but for the greater number that just specified is sufficient. The fluid extract of valerian is a good preparation, and may be given in doses of a drachm three or four times a day.

Opiates are also useful in some varieties of emphysema; they should be repeated often enough to quiet the cough; and in emphysema, as in common bronchitis, their effect is much enhanced by combining them with a nauseant. From a quarter to half a grain of opium will in general be found sufficient, if combined with the same or half the quantity of tartarized antimony. If ipecacuanha be used, which is much better and much safer, of course the dose should be larger.

The remedies which are most serviceable for ordinary bronchitis are in general equally applicable to that variety which complicates emphysema; it does not, therefore, require any specific direction for the treatment. It is to these cases that the physician is chiefly called; for in the large majority of patients the emphysema itself is not a sufficiently severe disease to attract much notice from the subject of it.

Sometimes cups may be applied between the shoulders, when there is great difficulty of respiration, the cupping of course re-

moving the congestion which increases the dyspnœa. Dry cups also often relieve the patient; they should be applied between the shoulders.

Attention should also be paid to keeping up a general circulation throughout the skin. Thus the patient should be dressed warmly, and take care to keep his skin generally dry; for exposure to damp and cool air is almost sure to bring about an increase of the symptoms of the disorder.

CHAPTER X.

ASTHMA—NERVOUS ASTHMA—FALSE ASTHMA—PAROXYSMS—DIAGNOSIS—TREATMENT.

THE term asthma is extremely vague, and is still used in a very loose sense. It is commonly applied to any condition of the respiratory system in which there is much oppression, especially if the dyspnœa comes on in paroxysms, and is attended with a wheezing noise during the inspiration or expiration. In many of these cases there is sufficient evidence of organic disease in the lungs or heart to account for the difficulty of breathing; hence the term asthma is then applied merely to a symptom, and does not designate a specific disease. In other cases there is no evidence of any organic alteration; and the asthma then becomes a peculiar disease, characterized by regular symptoms, but without definite lesions; it is therefore to be classed among those diseases to which the common designation nervous is applied. The term is a vague one; but if we restrict it to functional disorders which present a sufficient regularity of symptoms to identify them, there is little practical objection to it. In the present state of the science, therefore, we are compelled to admit a nervous asthma and a periodical dyspnœa without organic lesion.

The diseases of the lungs which are attended with paroxysms of difficulty of breathing, are a variety of bronchitis, emphysema, certain rare cases of miliary tubercles, and the presence of large tumors upon the trachea or the larger bronchial tubes. The asthmatic variety of bronchitis I have already treated of under its appropriate head; it is one of the most painful and harassing to the patient, but at the same time is the most curable variety of asthmatic diseases, for it often yields to the continued use of

ipecacuanha, and other remedies of the kind, with appropriate counter-irritants. The probabilities of cure are of course much enhanced by a voyage to a milder climate. Emphysema may be palliated, if not cured. Miliary tubercles constitute generally the most intractable, and often the most rapidly fatal variety of phthisis, but do not often produce the spasmodic difficulty of respiration known as asthma.

The tumors which give rise to periodic dyspnœa at first will cause a permanent difficulty of breathing if they increase much in size; they are sometimes scirrhous growths, but more frequently aneurism of the arch of the aorta in adults, and scrofulous enlargement of the bronchial glands in children. The dyspnœa is at first not permanent in these cases, because the obstruction to the passage of the air is not sufficient to cause great difficulty of the respiration without some congestion of the bronchial mucous membrane; this is more and more apt to recur as the disease continues to advance, and the case may readily be mistaken for one of nervous asthma.

After striking those cases of false asthma from the list, we next come to the diseases of the heart which simulate the same disorder. These are quite numerous; indeed, any serious disorder of the heart which impedes the circulation may congest the lungs, and, as a necessary consequence, great dyspnœa will result. The oppression will be very nearly in proportion to the difficulty of the circulation through the heart, and must of course be greatest in those cases in which the valves are most obstructed. These diseases constitute some of the most severe cases of those classed under the general head of asthma.

There remains, then, a nervous asthma, which cannot be classed under these heads. This disease, like most other chronic affections, is in a great degree hereditary, and often passes through several members of a family; all, or a large number of the children of one family, are often subject to attacks of it upon exposure to slight exciting causes. These causes are extremely various; but they are in general such as act particularly upon the nerves of the respiration, and produce a slight oppression, even in individuals who are not at all asthmatic; such as the inhalation of deleterious gases, certain perfumes, a heated, and especially a

crowded room, changes of temperature, or changes in the barometrical conditions of the air, will all occasionally produce the same results. The effects of atmospheric changes which are not connected with temperature, and can only be recognized by a delicate hygrometer or barometer, are very peculiar; a very little difference in the moisture, or in the altitude of a particular spot above the level of the sea, being often sufficient to bring on or to remove a severe attack of asthma. The change from a lower and more crowded to a higher and more airy part of the same town will often produce the same effect.

These attacks of nervous asthma are often periodic, or at least especially apt to recur at particular seasons of the year, which are not always the same, although the summer is in general more apt to favor the development of the disease than colder weather. But there is no disorder which is proverbially so peculiar in its time and mode of attack as asthma—the most opposite conditions will modify the action of the nerves of respiration. These conditions do not, however, vary much in each individual; they are generally sufficiently regular, but they are extremely different with different persons who might at first sight seem to offer the same variety of the disorder. This idiosyncrasy is not more remarkable than that which is observed in relation to many other functions of the body, especially the digestive, and is of course equally inexplicable.

Symptoms. The symptoms of nervous asthma are similar in this respect, that all who are affected with the disease are liable to sudden and violent paroxysms of dyspnœa, or to slighter derangement of the respiration; at the same time there are no decided signs of bronchial inflammation. If the respiration be examined, the inspiratory sound is feeble, but at first there is generally no rhonchus; the wheezing, which is occasionally heard at a distance from the patient, is produced almost exclusively in the larynx. The rhonchi and other signs of bronchial irritation are heard if the attack is accidentally complicated with acute bronchitis.

If the spasmodic difficulty of breathing continue for a certain time, a few hours, for example, there is always more or less rhonchus to be heard in the chest. This is at first the sonorous or

sibilant rhonchus, both in inspiration and expiration; not fixed in any portion of the chest, but wandering about, at one moment heard, and at another ceasing, at any given point.

Almost as soon as they appear, some trace of mucous rhonchus may also be heard, generally at the base of the lungs; sometimes, however, there is little or no liquid in the chest, and the sounds are limited to the sonorous and sibilant rhonchi. When there is much liquid secretion there is a subcrepitant rhonchus heard at the same time with the mucous—that is, the liquid is secreted in the smaller tubes, which of course produces this sound. Some of these rhonchi are always produced in every paroxysm of asthma, being caused by the swelling of the mucous membrane, which of course gives rise to a dry sound, the moist rhonchi occurring only when there is some liquid secreted.

The cough in cases of asthma is also to a certain extent peculiar. It is always spasmodic, sometimes violent, and may generally be known by its peculiar intonation. It varies very much in different attacks of the disease, and in different individuals, and is often so slight as to be evidently due to an effort made by the patient to free his chest from the difficulty of respiration.

There is sometimes a certain amount of expectoration in nervous asthma, but not always. Upon examination, the matter expectorated is found to consist merely of a thin, glairy mucus.

The pulse and circulation are sometimes totally unaffected; but if the difficulty of respiration be extreme, there is generally an increase in frequency of the pulse, though not a decided fever.

Paroxysms of true asthma terminate by a gradual decline, or, as in the variety termed asthmatic bronchitis, the attack is not relieved until a free secretion of glairy liquid from the bronchial membrane takes place; in either case the disorder is singularly apt to return in a short time upon a renewal of its exciting causes.

Diagnosis and prognosis. The diagnosis of the disease is, like the prognosis, exceedingly simple. The disorder may always be recognized by the presence of the periodical dyspnœa, and the absence of any decided evidence of structural change. The prognosis is, on the whole, highly favorable; for few cases of the

kind terminate unfavorably, but, like the asthma which arises from emphysema, the disease is exceedingly difficult to remove. At the same time the affection is so peculiar in its nature that it often ceases abruptly, without the slightest assignable cause; and at other times, an apparently insignificant impression made upon the nervous system, either directly on the nervous expansions, or indirectly through the medium of the imagination, will often stop a paroxysm, or postpone one for a long period. The prognosis, therefore, is peculiar; and it is very necessary to be guarded in our promises of cure, or in our anticipations of an unfavorable result when the case is most unpromising.

There is no positive *morbid change* produced by this disorder, the only alteration that we can conceive to exist in the lungs being a congestion or constriction of the mucous membrane. But it is very evident that this alteration does not amount to such a lesion as could be recognized after death.

Treatment. In most patients asthma may be greatly relieved by attending to the exciting causes of the disease, and carefully avoiding them when practicable. This is often less difficult than it would appear to be at first sight; for a very slight change of residence from one situation to another in the same city or district of country will often suffice. Sometimes a more distant removal becomes necessary, at least at the season of the year when the disorder is most apt to recur. Every patient is not, however, fitted to decide as to the proper change of situation. In the same way a change of occupation, or even the avoidance of certain departments of a particular business, will often succeed. If these attempts fail, and the patient is willing to make the sacrifice, a more decided change is advisable; and, in making it, the warm, moist regions of the sea-side, will generally be found preferable to the drier and more hilly country.

There is, however, no one rule for the choice of a place of residence; the most different localities sometimes answer best. But every one should select such a place of residence as he finds by experience to be best adapted to prevent a return of the disorder.

The hygienic precautions not connected directly with the condition of the air are less certain in asthma than in most other

diseases; and we must here also rely chiefly on the experience of the patient. Those causes which tend to produce bronchitis favor the development of asthma, although they do not cause it. Hence the avoidance of cold and unnecessary exposure is essential, unless the experience of the patient should teach him that a cold atmosphere agrees better with him than a warmer one. In either case, however, the impression of prolonged cold upon the surface is almost always deleterious, whatever may be its direct influence upon the bronchial mucous membrane. Excesses in diet are also often exciting causes, and the particular perfumes or stimulants of the bronchial membrane which act unfavorably upon the disease, are generally well known to every patient.

There are many modes of arresting the paroxysms, and for the most part the remedies resemble each other only in their general power of producing a decided action upon the nerves of respiration. Frequently these remedies are the narcotics; at other times a mere counter-irritant applied between the shoulders will prove effectual in cutting short the paroxysms. In some cases a galvanic plate applied upon the nucha, and communicating with another placed at the point of the sternum, will instantly check an attack of this disorder; and although the cure is not always permanent, yet in some instances the disease does not return. The nauseants and antiphlogistics, which are often useful in emphysema, are sometimes equally effectual in arresting the paroxysms. Among them the tincture of lobelia is one of the most certain and convenient, but with some patients it is oppressive and irritating.

The various narcotics which are from time to time resorted to for the relief of asthma may be administered in the usual way, or be inhaled into the lungs, and thus brought directly in contact with the bronchial membrane. Thus stramonium, tobacco, and other remedies of this class, are often smoked with great benefit; and a method recommended lately by M. Raspail is sometimes of advantage. This consists in inhaling the vapor of camphor; a few pieces of it are placed in a quill, and the patient may breathe through it. The slow volatilization of the camphor brings it directly in contact with the lungs.

The burning in a room of pieces of paper soaked in a solution of saltpetre, and dried, sometimes produces an effect upon the paroxysm in asthma. This remedy is, however, excessively uncertain.

These means are, it must be remembered, all palliative, and there is generally no certain method of cure for the disease. A careful study of the exciting causes, and attention to some very simple hygienic precautions, are the most promising means of treatment. Occasionally we find that plans of treatment which appear the most odd and singular will entirely cure, or at least arrest, a paroxysm of this disease. A method of treatment which I have known to be successful, consisted in applying two galvanic plates, one to the nucha, and the other to the epigastrium. Of course these were connected by a wire. Dr. Jackson, of Philadelphia, used it with great benefit in a few cases; in others it utterly failed.

CHAPTER XI.

PNEUMONIA—ANATOMICAL CHARACTERS—PHYSICAL SIGNS—SYMPTOMS—TREATMENT—VARIETIES.

In the last chapter I concluded the subject of diseases of the mucous membranes lining the bronchial tubes. As I had previously described the inflammation of the investing membrane, it now only remains for me to give an account of the affections of the parenchyma of the lungs. It was necessary to treat of the diseases of the membranes first, because the parenchyma is very rarely, if ever diseased, without the inflammation extending to them; for the tendency of disease of the lungs is to produce inflammation both of the mucous and serous membranes connected with them. What, then, is the parenchyma? To answer this question, it will be necessary to reflect upon the anatomical structure of these viscera. The bronchi continue to divide and subdivide, the ramifications becoming smaller and smaller after each division, and terminating in vesicles arranged in lobules; the vesicles of each of these communicate with one another, but not with those of the adjoining lobules; and each lobule receives a blood-vessel, which ramifies within it, and is distributed to the vesicles in the cellular tissue, which invests and unites them together.

The parenchyma may then be said to consist of the air-vessels, the blood-vessels surrounding them, and the cellular tissue; or the term may be extended further, so as to include the ramifications of the tubes within the lobules, yet not the tubes which lead to them. The latter definition answers better in a pathological view, inasmuch as the smaller tubes are always involved in diseases of the portion of the parenchyma through which they pass. The term parenchyma being then understood to include these finer tubes, we designate the disease as bronchitis when the inflamma-

tion attacks the large bronchial tubes, but extends no further than the tubes which lead to the lobules: as pneumonia, when it extends to the smaller tubes within the lobules, and to the air-cells of the part affected.

Anatomical characters. Pneumonia, which is an inflammation of the parenchyma of the lungs, may commence in two ways—either as a bronchitis, the inflammation in this case extending to the smaller tubes and air-vessels; or it may originate in the vesicular structure, and subsequently involve the larger tubes, just as dysentery may commence in the form of diarrhœa, and pass into dysenteric inflammation, or originate in the latter form and present the symptoms of dysentery from the first.

When the bronchial tubes only are inflamed, as soon as a secretion of mucus takes place it is removed from the body, and the inflammation is partially relieved, so that the disease rarely does much harm; but when the vesicles in the lobules are inflamed, the exit is closed, and the fluid accumulates in the lung, thus increasing the congestion and impeding the respiration, but not relieving the inflammation by a natural depletion. This fluid consists at first of a bloody serum, and is often of a reddish color. It afterwards passes through the stages of lymph and pus. In hemorrhage, the blood effused in the cellular tissue is arterial in its character; in apoplexy it is venous, and in inflammation it partakes in a measure of the nature of both. The lung at this stage of the disease yields readily to pressure with the finger, and the fluid can be expressed from it.

In post-mortem examinations the sound appearance may be confounded with engorgement produced after death, in a dependent portion of the viscus; and there is frequently some difficulty in making the distinction between the two—but the redness of inflammation is always brighter, and the softening of the tissue is more decided. Still, the two conditions are not very dissimilar, for the congestion, if it occur during life, may readily pass into inflammation.

Pneumonia passes through several stages between its commencement, which I have described, and termination; and its symptoms, in accordance with the changes of structure, are divided into four stages. The first is characterized by engorgement of the tissue;

the second by induration, which has received several names, as hardening, red softening, hepatization. It is called hardening, on account of the increased consistency which is perceived when it is slightly pressed: softening, on account of the facility with which it is broken, if the pressure be increased; hepatization, from its resemblance to the tissue of the liver. The vesicles of the lung, being deprived of air, and engorged with blood, resemble the acini of the liver, their color being thus changed to a red or brownish red. In the case of children, this resemblance is so close, that I have known a by-stander to mistake a piece of lung for liver, although both tissues were before him. A small piece of lung in this stage of the disease will sink in water, although a large mass of it may float, on account of some portion of it containing air in its cells; whereas, in the first stage, the whole of the tissue is lighter than water.

The bronchial tubes are red, and filled with a fluid containing a large portion of lymph, which in many cases closes the smaller tubes, thus reducing the lung to a uniformly solid mass. If the lung be torn, or even if simply cut, it presents an irregular granulated appearance, which arises from the vesicles being separately hardened and enlarged, while they still retain their individual form. They therefore project above the level of the adjoining cellular tissue.

In the third stage, the lung remains solidified, although softened, but assumes a yellowish color. In this stage the lung contains a considerable quantity of pus, diffused through the cellular tissue, and deposited in the vesicles. The tissue loses its granular appearance and becomes more smooth and polished, the vesicular structure having been completely obliterated. It yields readily to pressure, and breaks under the finger, affording a puriform liquid, which at first consists of a mixture of pus and blood globules floating in serum, and afterwards of pure pus. By placing the diseased lung under a stream of water, the parenchyma may sometimes be so completely removed as to leave nothing but the bronchial tubes. The bronchial mucous membrane is not so red in this as the second stage, and the tubes contain purulent liquid.

We may admit a fourth stage, in which the parenchyma is soft-

ened down and removed by expectoration, and a cavity remains, resembling an abscess in the other tissues of the body; a pus-secreting membrane is formed, and pus is thrown out, which becomes less and less in quantity, until cicatrization takes place, and a cure is effected. This stage of the disease is rarely met with; but when it does occur the patient usually recovers; for a simple abscess in the lungs is a perfectly curable lesion. However, if the patient has strength enough to go through the first three stages of the disease, he will generally survive the fourth, though he may require the aid of artificial stimulants. The symptoms are generally somewhat relieved by the formation of an abscess, as the inflammation is thus circumscribed in its locality. If, however, instead of there being a circumscribed abscess, the pus is diffused through the lung, a fatal termination will generally take place.

Physical signs. The physical signs of pneumonia, like the lesions, occur in a regular series. The signs in the first stage are obscure, but in the second they become very plain; hence they are looked upon as the pathognomonic signs of the disease. In the first stage the lung is infiltrated with a thin liquid; this produces a sort of rustling sound of the respiration, and not unfrequently the inspiration at the time is rude; that is, the vesicular murmur loses its natural softness and fullness, and the air rushes abruptly into the cells.

Subsequently we meet with another sign, which is said to be pathognomonic of the first stage. This is the crepitant rhonchus. It is indeed pathognomonic when it does exist, but it is not present in all cases; for when the inflammation is seated near the center of the lung, the engorged vesicles cannot dilate; as this rhonchus is produced by the expansion of the diseased vesicles, of course it cannot be heard. Besides the healthy tissue, which is to be found between the ear and the diseased lung, gives rise to a healthy vesicular respiration, and prevents the crepitus from being heard after it is formed in the inflamed portion. But when the seat of the inflammation is near the surface it always occurs. There is also slight dullness on percussion, which is caused by the secreted liquid partially displacing the air in the tubes. The dull-

ness is, of course, very inconsiderable, for the air is not completely expelled from the diseased portion.

The portion of the lung at which the signs of the first stage are usually to be looked for, is the upper part of the lower lobe; for there the first evidences of pneumonia usually occur. Hence in every suspected case, we auscult the lungs particularly at that point.

The signs of the second stage are more strictly pathognomonic of the disease. In this stage the tissue of the lung is completely altered, and this alteration is attended with corresponding physical signs. On percussion, we find complete flatness, as the cells are filled with fluid, and no air whatever is contained within them. Auscultation gives us first a bronchial respiration, which is more marked in the second stage of pneumonia than in any other affection of the lungs, as the tissue is perfectly consolidated without any obliteration of the tubes. It is that variety of bronchial respiration which on account of its loudness has been denominated tubal; it is most distinctly heard at the root of the lung, where the tubes are of the greatest caliber.

Bronchial resonance of the voice, or bronchophony, is also heard, and in fact it always coexists with the bronchial respiration. If the patient breathes rapidly, especially after coughing, the crepitant rhonchus is also heard in almost every case accompanying the bronchial respiration. This would seem to arise from a portion of the lung remaining in the first stage of inflammation, which at least is still capable of admitting air to the vesicles. It is then heard in trains, like the crackling of wet powder, in the tissue which has not been indurated, and which surrounds the solidified portion. This state of things is very frequently met with.

This fact, of the persistence of crepitant rhonchus, especially after smart cough, is often misunderstood, when it occurs in connection with pneumonic induration of the lung. It is certain, however, that it does almost always exist; sometimes it is heard in the ordinary respiration of the patient; at other times it requires a strong inspiration, such as only follows an effort of coughing. Hence it is easy to reproduce this rhonchus in parts of the lung where before it was heard either scarcely or not at all, by direct-

ing the patient to give a short cough. This fact gives us the clew to the cause and seat of crepitant rhonchus; it is a sign not produced in the vesicles of the lung so much as in the finest bronchial tubes. When these tubes are occluded by the presence of lymph or mucus, all crepitus sometimes disappears; but when the contained lymph is temporarily removed by an effort of coughing, the rhonchus reappears. Now, it must be clear to every one who is familiar with the pathological lesions of pneumonia, that the induration of the lung is not modified by an effort of coughing; the convulsive movement in which the cough consists can only remove obstructions from the finer bronchial tubes.

Thus the crepitant rhonchus is strictly a sign of pneumonia, but of pneumonia rather passed into the second stage than remaining in the first. As in the second stage the vesicular tissue of the lungs is entirely obliterated, the rhonchus must be produced either almost or altogether in the finer bronchial tubes, the exceptions being those cases in which there is not yet a perfect consolidation of the lung. But even in these cases, the rhonchus is generally formed in the course of the smaller tubes, and is of course therefore a sign as strictly produced in them as it is in decided hepatization of the lung. This fact I have been for a number of years in the habit of teaching in my lectures on this subject.

These signs are present in all cases except when the patient breathes too feebly to impel the air through the tubes, when of course they are not heard: but as they are so constantly met with, they are usually described as the pathognomonic signs of pneumonia. The patient should always be directed to cough when we suspect that he is in the second stage of pneumonia; and we will then find that the bronchial respiration is made much more distinct, and the air is driven so suddenly into the smaller tubes during the following inspiration, that a very characteristic crepitus is produced in the same spot as the bronchial respiration.

The percussion in the second stage of pneumonia becomes perceptibly dull as soon as the indurated portion of lung amounts to nearly the size of a pigeon's egg. When it exceeds that size, the resonance gradually becomes more and more dull, in proportion as the induration approaches the surface of the lung. When the disease has attained a considerable extent, involving the whole

lobe of a lung, the percussion becomes exceedingly flat, and much duller than it is in any other disease not producing entire solidification. In cases even of entire induration of the lower lobe of the lungs, if the percussion be made sharply at the spot corresponding to the root, there may still be heard usually a faint resonance. This, however, is but slight, and requires a certain amount of skill for its production. It arises partly from the air contained in the large bronchial tubes, and partly because the sharp blow has produced a resonance in adjoining portions of healthy lung.

The signs of the third stage are not so characteristic of the disease; but if we have followed it through the previous stages we cannot be at fault, nor can we find any difficulty if the signs of the first and second or of the three stages be present at the same time. But if the patient is seen for the first time in the third stage, we may, by relying on the general symptoms, mistake the disease for an affection of the brain, which it sometimes much resembles. The signs are, in the first place, those connected with percussion, which is perfectly flat, as the lung remains solid, and very little air is contained in the tubes. The results given by auscultation are obscure, as the current of air has by this time been diverted from the diseased lung, just as the blood is diverted from a gangrenous limb, and therefore comparatively little bronchial sound is heard. The respiration is much less loud than in the second stage, but still remains bronchial; a mucous or subcrepitant rhonchus is also present.

We have, then, as signs of the third stage, flatness on percussion, feeble bronchial respiration, and mucous and subcrepitant rhonchus. The resonance of the voice is proportional to the respiration, and is of course not very great. These signs are all very obscure, and therefore we may often be foiled when called to a patient in this stage of the disease. There may still be often heard in very strong inspirations a decided crepitant rhonchus; but this is rather owing to a portion of the lung which remains in the first or second stage, and admits the air in very strong inspirations.

Thus it is evident that the third stage of pneumonia is less marked by the characteristic signs than the second stage; but

still by carefully ausculting the patient, and directing him to cough, so as to clear out the obstructed bronchial tubes, he may reproduce the signs of bronchial respiration and bronchophony. These signs, however, rarely disappear entirely; they merely become more feeble in the second stage, because the tissue of the lung, in place of remaining a hard, resistant mass, bcomes soft and infiltrated with pus.

The difficulty of auscultation is, however, particularly great in those cases in which an abundant mucous and subcrepitant rhonchus is heard. This is due to the filling up of the larger bronchial tubes with pus and mucus, and of course in that way the bronchial respiration is diminished.

After this has continued for a certain time, there are of course cavernous respiration and pectoriloquy; but these signs are much less distinct than when the cavities are produced in pulmonary phthisis; partly because the induration of the surrounding tissue is less firm, and partly because the cavities are in some degree filled up with mucus.

The signs of the fourth stage, or that of abscess, are the usual signs of formation of a cavity—that is, at first a mucous rhonchus, becoming more loose and large, until at last a well-developed gurgling is heard, produced by the passage of air through the pus contained in the cavity. The following table will give a condensed view of the physical signs connected with the different stages of the disease:—

First stage, or engorgement.	Rude or harsh respiration; crepitant rhonchus.	Percussion clear, or nearly so.
Second, or hepatization.	Bronchial respiration; bronchophony; crepitant rhonchus.	Percussion flat, or very dull.
Third, or purulent infiltration.	Bronchial respiration in large tubes, feeble or absent elsewhere; mucous and subcrepitant rhonchus; bronchophony imperfect.	Percussion flat.
Fourth stage, or abscess.	Cavernous respiration, gurgling.	Percussion flat.

Several of these stages may coexist in the same lung; but the signs of each may be recognized without difficulty, and the proportionate extent marked out with tolerable precision.

When the disease terminates by recovery, it gradually retraces

its steps until it returns to a healthy state. The signs connected with this return to health are called the signs of return, or of recovery: their regularity depends upon the stage which the disease had previously reached. If the disease advance no further than the second stage, it will regularly return to the first. When first the crepitant rhonchus of return is heard, it is looser or more moist than the true crepitant; this gradually subsides, and the vesicular respiration reappears, but remains for a long time much more feeble than it was previously to the attack.

The crepitant rhonchus of return has this character, simply because the secretions are more abundant, thinner, and pass into the larger tubes. This fact is in itself a corroboration of what I have already stated as to the production of crepitant rhonchus, not in the vesicles of the lung, but in the finest tubes.

The bronchial respiration and dull percussion do not suddenly cease, but remain in some degree for a considerable time after the cessation of most of the symptoms of the disease, and often may be distinctly heard after the health of the patient is almost restored. This depends upon the consolidation of the lung and the difficulty with which the tissue returns to its vesicular expansive condition.

When, however, the disease has reached the third stage, this series of changes does not occur. The mucous rhonchus is the first sign of improvement observed; it depends upon a large quantity of fluid which is poured into the tubes. The crepitant rhonchus of return is not heard because no air passes through the smaller tubes. The fluid which is produced in the bronchi consists of mucous and purulent matter, resulting from the breaking down of the diseased tissue, and the secretion from the tubes passing through the inflamed mass. The secretion of this fluid contributes very much to the relief of the disease. The rhonchus gradually becomes more and more mucous until it is perfectly natural in its appearance; at last it disappears.

The return from the fourth stage is marked by the secretion of pus becoming less and less, and at last disappearing with the cicatrization of the parts involved in the abscess, while the secretion becomes entirely mucous in its character.

As these changes take place, the cavernous respiration gradu-

ally diminishes, but does not always subside entirely, because if the cavity is of a certain size, and communicates freely with the large bronchial tubes, this sign may remain even after complete recovery. If, however, the cavity is small, and not situated in such a part of the lung as to communicate with a large tube, the cavernous respiration may even totally disappear, and nothing remain after recovery but a feeble sound of vesicular respiration, together with a slight bronchial character. The signs of the voice must of course coincide with those of the respiration; the gurgling gradually diminishes, and generally disappears altogether with the conclusion of the disease. There sometimes remains, however, a little mucous rhonchus even after complete recovery.

These stages belong to pneumonia of a perfectly frank character; they are, however, liable to be modified by various circumstances which are necessarily attendant upon the disease. There are some lesions of other organs than the substance of the lungs always found in pneumonia; that is, inflammation of the pleura and of the bronchial mucous membrane. The pleurisy is at first dry, and merely produces slight pain and a feeble sound of respiration.

When the pleurisy is slight, the affection is simply called pneumonia; when the pleurisy is severe, and attended with a large effusion, it is called pleuropneumonia; and when the pleurisy is considerable, with very slight inflammation of the parenchyma, it is usually merely termed pleurisy. When the pleuritic effusion is considerable, the signs of one or the other affection predominate according to the relative stage of each disorder; the pneumonia is apt to decline sooner than the pleurisy, which may remain for an indefinite period after the cessation of the inflammation of the substance of the lung.

The bronchitis which attends pneumonia may be confined to the tubes which lead to the lobules which are inflamed, or it may extend throughout the bronchial tree. That which is confined to the inflamed portion of the lung is always present to a greater or less degree; but the bronchitis which extends fairly throughout the tubes is extremely variable, and generally takes place under two different circumstances. In one the bronchitis begins as an ordinary catarrh, and the pneumonia occurs afterwards during

its progress. In the other the bronchial affection comes on late in the disease, and generally in the third stage of it, when the purulent secretion is copious, and passes into the bronchial tubes.

The inflammations, both of the bronchial mucous membrane and of the pleura, are always essentially parts of pneumonia—especially the bronchitis. When the disease is limited to the central portions of the lung, the bronchial membrane only is sometimes inflamed; but when the inflammation extends toward the surface of the lung, there must always be an accompanying pleurisy. The secretions in the bronchitis, however, become slight during the progress of the inflammation in the substance of the lung; and the physical signs of the former affection must then of course diminish. They increase when the pneumonia is either terminating in recovery or passing into the third stage. The bronchial rhonchi then of course reassume their severe form, and sometimes last after the pneumonia passes off.

The accompanying pleurisy, also, is sometimes difficult of diagnosis, except from the pain which is generally present to a greater or less degree. Sometimes, however, we find the friction sound almost at the beginning of a pneumonia, especially at the posterior portion of the chest. But this sign, when it exists, soon disappears; and then there remains no evidence of pleurisy perceptible to the auscultator. Of course in those rare cases in which there is a large pleuritic effusion, coexistent with pneumonia, the respiration is so faint that almost no crepitant rhonchus is heard except after a strong effort of inspiration. The bronchial respiration may be readily confounded with that sometimes met with in ordinary cases of pleurisy; it is therefore easily seen that these cases may be overlooked and mistaken for ordinary pleurisy, unless great care is exercised. It is however true, that attention to the general symptoms will often lead the physician to suspect at least the character of these peculiar cases.

Having mentioned the physical signs of frank pneumonia, I shall now proceed to consider the functional signs of this affection. These are of three kinds—local, secondary, and general. The local comprise cough, expectoration, frequency and mode of performance of the respiration, and the pain produced by the

act of breathing. By secondary signs, we mean the affections of the brain, alimentary canal, the assistant chylopoietic viscera, etc. The general signs are those which are common to all inflammatory affections, as the condition of the circulation, etc.

Local signs, cough, etc. The cough is often at first the ordinary cough of acute bronchitis, which is either hoarse or a loose mucous cough. In this case the bronchitis is the predominant affection; as soon, however, as the parenchyma becomes seriously affected the cough changes its character, assuming the type which is called pneumonic. The pneumonic cough is short and suppressed, which results partly from the pain felt during the act of coughing, and partly from the impossibility of inflating the lungs completely; hence the force of the column of air which is expired during the act of coughing is not sufficient to cause a loud and distinct sound.

The pneumonic cough begins from the first, if the disease attack the parenchyma and pleura before passing through ordinary bronchitis. The cough sometimes exhibits this character from the first. In some cases of pneumonia the cough is wanting throughout the course of the disease, which is then said to be latent; in such cases the patient is generally aged, or the pneumonia succeeds another affection. As the disease proceeds, secretion takes place, and the cough again becomes loose; when an abscess is formed it becomes exceedingly loose and rattling.

The frequency of respiration is increased in pneumonia, and the degree of this increase is a tolerably exact indication of the extent of the affection. The frequency of respiration arises from the diseased lung being rendered unfit for the performance of its functions, so that a smaller portion of the blood is exposed at once to the action of the air, and a smaller quantity of the air is inhaled during an inspiration. Therefore it must be changed more frequently. Besides, the inflation of the healthy portion of this lung is less complete than natural, because the motion of the chest is partially suspended, and the action of the respiratory muscles is less complete. Where only one lung is slightly diseased, the frequency of the respiration is but very little increased. If the disease embraces the whole of one lobe of the lung it is increased to forty or fifty a minute: and when both are involved, the respi-

ration will be as frequent as fifty or sixty in the minute. Should it be more frequent the extent of mischief is very great. It must be evident, then, that this sign is important for the prognosis of the disease.

The mode of performing respiration differs from that observed in the healthy state. The patient breathes irregularly; the respiration is usually high, and is performed chiefly by the side of the chest which is not inflamed. At first it is not strictly abdominal: but after pneumonia has continued for a time, this character is developed, and then the ribs remain nearly motionless.

The decubitus in pneumonia is almost always strictly dorsal; the patient is however often obliged to lie with his head elevated, sometimes at an angle of 45°. The reason of this is the greater facility afforded to respiration.

The pain is very variable, and is proportioned to the inflammation of the pleura. When the inflammation is situated near the surface of the lung, the pleura is necessarily much involved, and the pain is consequently acute; but when it is deep seated, there is, generally speaking, little or no pain. In the old and feeble the pain is scarcely felt, whatever be the portion involved. Therefore, as in many cases it is wanting, and as when present it does not indicate the extent of the pulmonary inflammation, it is a sign of comparatively little importance.

The expectoration at the commencement of pneumonia consists of mucus, such as is observed in ordinary bronchitis, and differs but little from the healthy secretion. As the disease is developed it becomes viscid and transparent, and not infrequently is of a rusty color, but the viscidity and transparency are considered as the characteristic properties of the pneumonic sputa. It is sometimes so viscid that it will not flow from the vessel containing it, although the latter be turned bottom upward. It is small in quantity, generally from one to four ounces in twenty-four hours. When it becomes more abundant, it is generally a sign that the disease is retrograding: sometimes it is mixed with yellow sputa from some other portion of the lung or tubes.

As the disease passes from the second into the third stage we observe an admixture of pus, which renders the liquid muco-purulent; it is at the same time much more abundant than it was pre-

viously; when it declines, the sputa become thinner and more mucous in their character. If an abscess form, the sputa become decidedly purulent, and a large quantity is either suddenly discharged or expectorated in a very short time. This is to some extent the case when the third stage is so far advanced that a considerable portion of the lung is softened into a pulp, even if there be no large cavity.

The secondary signs may be divided into those connected with the lungs and those dependent upon other organs.

Inflammation of other organs. Bronchitis and pleurisy almost always attend pneumonia, but their severity varies exceedingly. Tubercles are sometimes formed in the lung during the course of pneumonia or in its decline, which, though it is not probably the sole cause of their formation, in many cases hastens their development. Their formation, of course, increases very much the gravity of the prognosis. Emphysema is sometimes produced during an attack of pneumonia, principally in children. This lesion is not so important when it is an affection owing to pneumonia as when it has existed previously to the occurrence of the latter affection, in which case, by increasing the dyspnœa, it renders the prognosis more unfavorable.

The heart is very often secondarily affected in this disease; sometimes from the general diffusion of the inflammatory action, and sometimes from the imperfect performance of the function of respiration, the blood becomes congested in the right ventricle, and in some cases a coagulum is formed in the cavities in consequence of the imperfect circulation, and of the highly fibrinous state of the blood. But often, in addition to this, we find inflammation of the lining membrane of the left ventricle, which is much more frequently affected in this manner than the right, in consequence of the general law, that the arterial system is more subject to inflammation than the venous. This occurs in a considerable proportion of the severe cases of pneumonia.

The affection of the heart varies in intensity—sometimes the membrane is merely reddened, sometimes it is opake and thickened, partly from the deposition of lymph, and occasionally it is ulcerated; the ulceration is generally seated at the valves. These cases of endocarditis are sometimes distinguished with difficulty,

because the symptoms are in a great extent masked by those of the pneumonia. They always constitute a grave complication of the disorder.

The brain is very often affected in pneumonia, and when the inflammation of this organ occurs it is attended by delirium, such as takes place in common arachnitis. The medullary cerebral substance is not often the seat of the inflammation, which in almost all cases is confined to the membranes, and to the cortical substance. Dr. Louis says that one-sixth of the cases of pneumonia which he saw were complicated with an affection of the brain; like the inflammation of the heart, it occurs most frequently in the very severe cases of pneumonia.

If the cerebral symptoms should be severe the primary affection is generally masked by the secondary, which often gives rise to an error in diagnosis, as the signs of arachnitis remain very evident, while the functional signs of pneumonia are obscured, and therefore liable to be overlooked. The cough may cease almost entirely, and the expectoration disappear; and, in fact, all the thoracic symptoms may be concealed by the occurrence of the meningeal inflammation. Cases of this kind are sometimes distinguished with difficulty; they are not, however, very frequent. This complication adds very much to the gravity of the prognosis; and unless active treatment is resorted to at the commencement of the attack the disease is very apt to prove fatal.

The liver is sometimes involved in pneumonia, but the frequency of this complication varies at different seasons and in different localities, being much more common on our Southern Atlantic coast than it is at the North. This inflammation of the liver is distinguished by some authors from bilious pneumonia, although it closely resembles it, and, as it seems to me, differs only in the bilious pneumonia, described by Stoll, being an epidemic disease. Its signs are jaundice, pain in the side and shoulder, and cerebral symptoms, such as stupor and somnolency, which are dependent upon it. This variety of pneumonia, though in some years common among us, is now much more rare. It differs from pneumonia in which the affection of the liver is a mere secondary complication, by the liver being attacked in bilious pneumonia simultaneously with the lung.

The right lung is the one which is always most inflamed in pneumonia complicated with the inflammation of the liver; and the transmission of the inflammation from the lung to the liver, in the simultaneous attacks of the two organs, shows that there must have been previously a disorder of the liver, which favored at least the extension of the disease. Hence the affection is so frequent in warm climates and miasmatic situations. This complication certainly adds much to the difficulty of diagnosis without the physical signs, especially as the cerebral symptoms, such as stupor or delirium, are generally so well marked as to suppress in a great degree the cough.

Inflammation of the stomach and bowels, of the œsophagus and pharynx, have all been observed in pneumonia—and also inflammation of the kidneys; but these complications are not more common in this than in other inflammatory diseases. They may be known by their proper local signs, and I shall therefore not enter into a minute account of them.

General signs; capillary circulation. A sign which may be called general, although confined to very narrow limits, is the appearance of the face, for this depends upon the capillary circulation. In acute cases we meet with a circumscribed flush of a circular form, and which is sometimes confined to one cheek, sometimes found in both. When one cheek only is affected in this manner it is more frequently, though not invariably, that which corresponds with the diseased lung. In some cases the whole face is flushed, the color varying from a light to a deep red; sometimes it is still deeper, and may be almost of a bluish color. The whole countenance is generally changed. These various tints depend upon the greater or less obstruction of the circulation of the blood through the heart and lungs; they are darker when the difficulty of the circulation is greater, and often become bluish about the lips and nostrils, while the rest of the face is pale, if a coagulum should form in the heart. Dilatation of the nostrils in each inspiration is another symptom; this depends upon the dyspnœa, and its extent is in proportion to the latter.

General circulation. The disease makes its appearance in the following manner: The patient is almost always first seized

with a chill; this lasts half an hour or more, and sometimes two or three hours, and when it goes off is succeeded by a fever, which continues during the whole twenty-four hours, but usually increases at night, and is rarely attended with extreme heat of skin. The pulse is full, hard, and developed at the commencement of the disease; in the latter stages it is frequently feeble. It is very generally from ninety to one hundred and twenty, and rarely becomes more frequent, except in the terminating stage of the disease. It is in most cases a good measure of the intensity of the inflammation, and a correct indication of the propriety of blood-letting; but the pulse is sometimes contracted, and at the same time the inflammation is violent; if bleeding be practiced, it rises and becomes softer. A careful bleeding, if the general symptoms be inflammatory, is the best guide in this matter.

The alteration of the strength is another sign which is connected with inflammatory diseases. In general the degree of diminution depends upon the importance of the part affected, and the extent to which the inflammation proceeds. Thus, a patient with pleurisy will continue to walk about until the effusion causes so much dyspnœa that he is compelled to keep his bed; whereas a slight pneumonia, with scarcely any local signs, will often enfeeble him so much that he will be unable to sit up.

Diagnosis. Although the physical signs are the most important in the diagnosis, as they indicate the extent as well as the nature of the affection; yet there are certain rational signs, which, taken together, may be considered as pathognomonic, namely, the chill and fever, the pain in the side, the entire loss of strength, the expectoration, flush, and dyspnœa: these are, however, often obscure at the commencement of the attack. The physical signs are often only required to ascertain the extent of the disease, as its character is rendered sufficiently apparent from the rational signs of sthenic pneumonia.

The character of the sputa also furnishes us with a valuable set of indications for diagnosis. When what is called the pathognomonic sputa of pneumonia exists—that is, having a rusty color and viscid consistence—there is no doubt of the character of the disease. In like manner the characters of the expectoration in the third stage are also pathognomonic; it is more abundant, and

has a puriform aspect. We can not only distinguish the existence of pneumonia to a certain degree by the expectoration, but we can also trace its stages with tolerable certainty.

The appearance of the countenance of the patient in pneumonia is often almost characteristic; we have a dark and circumscribed flush on one or both cheeks, a strong and frequent dilatation of the nostrils, an expression of great dyspnœa, and very often a considerable degree of somnolence. These signs, taken together, occur in no other disease; I have often, in passing through the wards of a hospital, been able to point out most individuals affected with pneumonia, simply by their countenance.

Prognosis. The prognosis is very variable in all diseases of this kind, as it often depends upon circumstances unconnected with the disorder itself. In ordinary frank pneumonia the prognosis is favorable where other things are not unfavorable—that is, where it attacks a person previously in good health, and the treatment is commenced early, for this modifies the disease very much when begun at an early period; but after it has continued a few days the prognosis is very little affected by it. When it is complicated with an affection of the brain or liver, the prognosis is more unfavorable. When this disease occurs in very old persons, it is always much more dangerous than when it occurs in the young or the middle aged. The danger seems to increase very nearly in proportion to the advance in years; aged patients dying often of the complicated form of the inflammation, which is apt to occur in this class of individuals.

In hospital practice the prognosis is much less favorable than in private; partly because the character of the patients is such as to expose them more to a fatal termination. Thus in France it used to be a rule that one patient out of every three would die, in the hospitals; and in this country the mortality is not much less, when the patients are admitted chiefly in the latter stages of the disease.

Duration. An ordinary case of frank pneumonia without treatment usually lasts from ten to twenty-one days, but if it has reached the third stage it will last much longer. If it has continued a few days before the commencement of the treatment, it rarely ends before the tenth day. If we treat it from the first, we may

frequently produce a partial jugulation of the disease, and shorten somewhat its duration. The observations made at Paris coincides in this respect with the experience of Dr. Jackson, of Boston, and the results obtained in Philadelphia. When the disorder terminates fatally, death usually occurs early in the third stage, or just in the passage from the second to the third stage. This stage is reached in different periods, sometimes in three or four days, but generally about the beginning of the second week.

Treatment. The treatment of frank pneumonia is. that of ordinary inflammation modified by the peculiarities of the organ affected. Hence bleeding is the most efficient remedy, and should be practiced freely at the beginning of the disorder. The method which has of late years been revived by Dr. Bouillaud consists in repeated bleedings, which are prescribed again and again for several days. This method is reduced to a regular formula, and in the hospital practice there are not so many obstacles to this system as in private; but it must be obvious to every one that no one method of treatment, or at least no regular formula, is applicable to all cases, and I do not, therefore, advise a uniform method of blood-letting. The best directions must be gathered from a knowledge of the disorder, and from the present symptoms of the patient.

Thus, in the commencement, a very large bleeding, pushed to the verge of syncope, is certainly best in a plethoric individual, or a moderately strong person, previously in good health, if the pneumonia is of a highly inflammatory kind—that is, if the evidence of vascular excitement be decided; for it is in these cases that the inflammation tends necessarily to diffuse itself, as it were, over a large surface, and to attack several organs, especially the serous tissues of the circulating system. A large bleeding is of course the surest means of checking this tendency, and is the most comforting remedy for the patient, as it at once diminishes the headache and the oppression, which are among the most disagreeable symptoms. A general bleeding produces much more effect than a local one, which is almost nugatory in its action upon the highly inflammatory cases of pneumonia, although very powerful in the later stages, or in the slighter forms of the disorder.

The venesection may in some cases be repeated either in the after part of the day in which the first bleeding was practiced, or

on the next day or two, if it seem necessary from the excitement of the pulse and the vascular action. That is, if the pulse should rise again, and especially if it should become more developed after the first bleeding. It is, as we may readily believe, impossible to lay down positive and unvarying directions for conditions of things which are in their nature changeable. But by reflecting on the condition of the lung, which at first is merely that of engorgement or commencing hepatization, and on the stimulant properties of the inflammatory blood, it is easy to see that bleeding more than once may become necessary, although in the majority of cases one single bleeding will suffice, especially if the sedative effects of it be kept up by other remedies, particularly the antimonials.

The appearance of the blood drawn is of course highly inflammatory—that is, much buffed, with a very firm crassamentum; this is a tolerably correct, but not a sure guide for the repetition of venesection. The blood will generally remain buffed, even in that period of the disease when bleeding is no longer of benefit.

A physician is frequently called to a patient late in the disorder, when the inflammation has either not been treated by bleeding, or the disease continues very severe. It is very difficult in these cases to decide as to the propriety of general bleeding; my own impression is, that bleeding is in these cases apt to produce a double influence, which is partly of mischief and partly of benefit. The inflammation, which is generally commencing in certain parts of the lung, or at least is much less advanced than in others, may be, to some degree, checked by the blood-letting; but those portions of the tissue in which the blood is completely stagnant, and, as it were, incorporated with it, are restored with more difficulty if blood be drawn from the general system. This is still more strongly the case, if the pneumonia has in part passed into the third or suppurative stage. The effect of blood-letting upon the general circulation is also in these cases often productive of evil, for the coagula which begin to form in the heart may become a greater obstacle to the circulation if the strength of the patient be lessened. The latter effect is difficult to demonstrate; but it has struck me in a number of cases that it was founded on good grounds, and I therefore state it for what it may be worth.

The action of local depletory means in acute sthenic pneumonia is more limited than that of general bleeding; the beneficial effects of these remedies are most important in the latter stages of the disorder, when a portion of the lung remains in the first or second stage of the inflammation, but the greater part of it has passed into the third stage. The local bleeding then seems to get rid of the remaining inflammation with less exhaustion of strength. When we meet with patients who have been neglected during the greater part of an attack of pneumonia, we are often obliged to limit our depletory measures to cups or leeches. The cups should be applied to the posterior parts of the chest, immediately over the inflamed lung. They should be used in considerable numbers, say six or seven, and may be repeated once or twice if the disease does not abate.

Blisters or tartar emetic ointment are not necessary, as a general rule, in acute pneumonia; for the disease belongs to those inflammatory disorders for the earlier stages of which blisters are not adapted. They are useful, however, at the beginning of the third stage, when the benefit from them is scarcely equaled by that from any other remedy in the treatment of pneumonia. Blisters then act with great power in checking the inflammation, at the same time preventing the collapse which is so frequent at this stage of the disease. The blister should be rather large, and in general the best place for it is under the axilla or between the scapula and the spine.

Tartar emetic ointment, applied so as to produce a very rapid pustulation, has been recommended under similar circumstances; but I do not in general regard it as possessing any advantages over blisters, while it is for many reasons inconvenient. Sinapisms, or other rubefacients, are often useful within certain limits —that is, as stimulants to the general strength, and as remedies which have a powerful influence upon the dyspnœa which attends the disorder.

Next in importance to general blood-letting, as a remedy in sthenic pneumonia, is the tartrate of antimony: this medicine may be given in several ways, either as a simple diaphoretic expectorant, or as a direct arterial sedative. In the former case it should be given in doses of from the sixteenth to a quarter of a grain every

two hours; in general a sixth of a grain is borne at first, and afterwards the patient should take a quarter of a grain, either alone or combined with nitre or calomel. The medicine is, in these doses, quite free from danger, except in a very few individuals of extremely irritable temperament; for there are some patients who cannot bear antimony in any dose, or in any form. In most cases, however, these small doses of a sixth or an eighth of a grain are attended with a disposition to sweating, and a diminution in the excitement of the circulation, which, on the other hand, always coincides with a diminution of the general inflammatory action that plays so important a part in the pathology of acute pneumonia. The antimony should generally be continued during the earlier stages of ordinary acute pneumonia, but it must be given in less doses when the strength of the patient becomes notably diminished, or the irritability of the stomach is excessive.

Of late years the contra-stimulant, or Italian method of giving antimony in very large doses, has been often resorted to in the treatment of pneumonia. This method has been perfected in France, and rendered much more safe. In my own practice, when I have followed this method, I have adopted very nearly the usual formula of the French hospitals; it is as follows: Tart. Antim., gr. vj; Aq. Menthæ., ℥vj; Gum. Acac., ʒij. M. Of this a tablespoonful may be taken every two hours. It is not always customary to add the gum-arabic, but the irritation of the stomach is certainly lessened by it. The antimony, taken in this dose, frequently produces no other effect than purging, which does not invariably follow. If the purging is severe it is readily checked by adding a few drops of laudanum to each dose. In itself, opium is rather objectionable, but it may be properly used if there is a decided tendency to purging.

The medicine should be continued in this dose for twenty-four hours, and not increased until the next day, when eight grains may be given instead of six; either in the same or in a larger quantity of vehicle. It is better to avoid giving it in too concentrated a form, for it then would probably produce much vomiting, or at least retching. If the tolerance has been established the first day—that is, if the remedy has not produced decided puking or purging, or very debilitating sweats, it may be safely taken

during the second day; and if the disease does not abate, the dose for the third day should be the same as that for the second. But after the third day there is some danger in continuing the antimony in a high dose, unless the patient is perfectly conscious, and his brain entirely clear; if the remedy be then attended by no uncomfortable sensations there is little danger in its administration. But if the patient is comatose, or even slightly stupid, very extensive inflammation and other structural lesions may follow the administration of the tartarized antimony without any symptoms to indicate them. If the cerebral functions are unimpaired, the condition of the nervous system is a very faithful guide for the administration of tartarized antimony.

The good effects of the medicine are shown by the diminution of the local signs, and of the oppression and fever; this is especially obvious in the local symptoms of the pulmonary inflammation, for the antimony seems to act more quickly upon the parenchyma of the lungs than even general bleeding. When the violence of the disease has declined, the remedy should be gradually diminished, and not suddenly discontinued; about two grains should be taken from the entire quantity each day until the whole amount is withdrawn.

There is some danger, or at least inconvenience in attempting to give antimony in these doses to certain individuals who possess a peculiar idiosyncrasy with regard to the medicine; for there are some persons who cannot bear it in any form, or even in small doses, without great nervous distress and extreme prostration. To such persons the remedy should never be given, at least not in any other than in very minute doses. Besides these peculiar cases, the antimony will occasionally produce injurious effects from the mere purging or excessive emesis which it occasions—chiefly from the former cause. It is true that the addition of a small quantity of opium, or even the mere persistence in the remedy without an opiate, will often suffice to arrest such a tendency; but if the patient should not lose this extreme susceptibility to the antimony, it becomes necessary to discontinue it.

I do not now, however, use antimony to as great an extent as I did when the earlier editions of this work were published. The reasons for this are several: in the first place the character of the

inflammation is not always as decided as it formerly was; in the second place, not a little inconvenience sometimes results from the contra-stimulant practice in pneumonia—that is, the administration of these excessive doses of antimony, although as a general rule, with care, no actual danger need be apprehended. I therefore comparatively rarely give the medicine in the large doses mentioned.

In small doses I regard it as advisable, as a diaphoretic and expectorant, and still use it very frequently.

The remedy which is at least equal in power to antimony is mercury, although its effects are somewhat different. When given in the period of hepatization, it acts in two ways—as a directly antiphlogistic remedy, and as possessing a peculiar power in preventing, or at least checking the formation of lymph; in other words, it is antiplastic. Hence, when given after bleeding, it is directly opposed to the progress of the inflammation, and modifies the products which result from it. Mercury should be given in such doses as to produce a full impression upon the general system, not amounting to ptyalism, but producing a slight action upon the gums, as an evidence of its constitutional effect. The proper dose is from a quarter to half a grain of calomel every two hours if it be desirable to make a rapid impression; from a third to half a grain three times daily if the mercury be designed to act more slowly. Even less doses produce at times a good effect.

The calomel is often combined with ipecacuanha or opium; but the latter remedy should be given with great reserve in acute inflammatory pneumonia: the ipecacuanha is free from danger, and is generally of service by its power of facilitating the operation of the mercurial and promoting secretion from the lungs. It should be given in doses of about one grain every few hours: generally the patient will bear it well. Sometimes it will be found that the ipecacuanha, even in this dose, will seriously disorder the stomach; if so, I immediately diminish it to half a grain. Indeed, in most cases, I am accustomed in the first place to give the remedy only in these latter doses, unless I find that it does not produce much effect. Opium must be administered in very small doses; not more than a quarter of a grain three or four times a

day; if the patient is affected with much stupor, or if the difficulty of breathing is at all increased, I at once give up the use of it.

The mercurial impression is usually followed by a rapid decline of both general and local symptoms. If it should fail, the disease assumes one of two forms—it either remains in the highly inflammatory condition, or it passes into the third stage of the disease. In the first case it may become necessary to recur again to depletory measures; in the second, blisters to the chest, especially with stimulating expectorants, and sometimes wine-whey, or in persons addicted to the abuse of alcohol, milk-punch may become necessary.

The expectorants which are of most value, when the antiphlogistic treatment has failed, are the eupatorium and senega, or the sanguinaria. These may be given in the form of infusion—half an ounce of eupatorium and two drachms of senega in a pint of boiling water—of which from a tablespoonful to a wineglassful, according to the susceptibility of the patient, should be taken every two or three hours; or the senega and sanguinaria may be combined in the dose of two or three drachms of senega and one of sanguinaria, in half a pint of boiling water; and a tablespoonful may be given every two hours, unless it should excite much nausea. In a few cases the dose may be increased.

Other expectorants are also serviceable, especially in the latter stages of ordinary pneumonia, when the disease is approaching convalescence, but has not yet fairly passed into it. Such are the tincture of lobelia, in doses of half a drachm every few hours, either alone or combined with a little sirup of squills.

After the acute symptoms of pneumonia are dissipated, the patient will often continue to cough a little; and on examination it will be found that the bronchial respiration has not entirely ceased at the root of the lung. This state of things depends upon the very slow absorption of the substance which is effused into the cellular tissue of the lung. It requires no special treatment, and in a little time will cease; still the patient should avoid exposure to the cold, damp air, and, to promote the resolution, he may wear a Burgundy pitch plaster, or some similar covering over the part affected.

The diet of patients affected with acute pneumonia must of course at first be strictly antiphlogistic. They should take only arrow-root, sago, or some similar article of food; after the disease has continued some days, it is always proper to give them some light broth, or chicken-water. When the inflammation has passed away entirely, the diet should be carefully increased. Sometimes, toward the close of the disease, it is even necessary to give the patient a little wine-whey as a slight stimulant, when the expectoration is going on abundantly; but the use of even this very mild alcoholic preparation should be only cautiously directed.

The drinks taken throughout the course of pneumonia should be mucilaginous—such as barley-water, or gum-water: these may be taken as the patient may fancy.

When the patient has recovered entirely, I am accustomed to direct in these cases, as in pleurisy, the application of a Burgundy pitch plaster over the affected side of the chest. This is a mild counter-irritant, and at the same time protects the patient against changes of temperature, to which he may have become somewhat susceptible.

LOCAL PNEUMONIA.

Besides the highly developed cases of pneumonia there is a variety of the disorder which is also simple and inflammatory, but more local in its action, attacking only a small portion of the lung, and therefore not producing the general inflammatory action of the severer cases. The local signs of pneumonia are present in these cases, such as bronchial respiration and crepitant rhonchus; but the fever is moderate, or may not exist at all, and the prostration is but slight. These cases cannot be distinguished from ordinary catarrh except by the local signs and the expectoration, which is usually, but not invariably, characteristic.

The duration of these cases rarely exceeds a fortnight, but in general it does not extend beyond ten or twelve days. Sometimes it is much shorter, the disease seeming to abate after a few days of continuance. The patient is not often confined to his bed, and in some cases he feels so little inconvenience that he will insist upon going out and following his usual employments.

The prognosis is always favorable, unless some unexpected aggravation of the disease should take place.

The treatment in this form of local pneumonia is extremely simple. The disease tends so universally to recovery that there is little difficulty in its management, and the large majority of cases would get well under any treatment. It is, however, quite possible to hasten its course toward recovery. For this purpose the best remedies are, at the very commencement, a moderate bleeding, or, after the first few days, one or two applications of cups to the affected parts. This treatment will relieve the lung and facilitate the cure, which is at last promoted by exciting secretion from the inflamed surface.

If the secretion take place readily, or if the inflammation is very slight, blood-letting in every case is not at all necessary; but if the pulse be excited the symptoms are more or less relieved by venesection to some twelve or fifteen ounces, and no inconvenience at least will result. Bleeding, however, is never followed by the same decided benefit as in the cases of highly inflammatory pneumonia.

The secretions from the lungs are promoted by the same treatment which is applicable to the declining stages of the last-mentioned variety—that is, the infusion or the sirup of senega or the wine of ipecacuanha, or the infusion of eupatorium or sanguinaria, or combinations of these with the senega. Small doses of the antimonials are also productive of prompt relief when the patient is feverish, but I do not regard the antimonials as so generally useful as the vegetable expectorants, especially the ipecacuanha. Toward the decline of local pneumonia the case requires some attention to distinguish between those cases which are really simple, and those in which there is a complication of pulmonary tubercles: in the latter case the disorder may pass into phthisis; in fact, it is then only one of the modes of attack of this disease.

ASTHENIC PNEUMONIA.

Inflammation of the lungs does not necessarily assume the asthenic form from the commencement; when it is connected with symptoms of depression, they may either come on from the begin-

ning or at an after part of the disease. In the third stage this naturally occurs to a certain extent—that is, when the suppuration has extended to a considerable portion of the lung, the patient sinks into a prostrate or asthenic condition very different from the false or apparent prostration which may arise very early in ordinary pneumonia from the dyspnœa produced by the extension of the inflammation to a large surface. But the secondary asthenia is not altogether similar in its symptoms to that which occurs much earlier in the disorder, and in its progress differs altogether from it.

There is one peculiarity which now and then characterizes this form of pneumonia; it oftener occurs in the upper lobe of the lung than do the more usual varieties of the disease. We should, therefore, in every case in which we suspect its existence, pass our ear carefully over the whole surface of the chest; we thus sometimes find the bronchial respiration and crepitant rhonchus most distinct near the summit of the lungs. The crepitus is generally larger and looser in this disease than in ordinary pneumonia. This increased size of the bubbles results evidently from the more liquid character of the secretion, and furnishes an additional evidence of what I have already stated as to the seat and cause of the crepitant rhonchus—that is, that it is a sound formed in the finer bronchial tubes, rather than in the vesicles of the lung.

When suppuration occurs, it takes place at an earlier stage than in ordinary pneumonia—sometimes within two or three days from its commencement. It is then shown by the usual symptoms—that is, a change to a purulent expectoration, with greater prostration of the individual. At the same time the bronchial respiration becomes less distinct, and mingled with the mucous or subcrepitant rhonchus. The rhonchi are generally more abundant, and more extensively diffused over the lung than in ordinary pneumonia.

The causes which render pneumonia asthenic at the earlier stages of the disorder may be referred to three classes: advanced age, previously enfeebled health, and certain epidemic causes which are not known. Neglect and exposure to continued cold

favor the transformation of ordinary pneumonia into this variety, and have some influence over it at the beginning.

The local signs and the expectoration of asthenic pneumonia do not differ from those of the inflammatory variety, except that as it passes more quickly into the suppurative stage there is but little viscid transparent expectoration; it very soon takes on the characters of the third stage, and in some cases the viscid inflammatory sputa are totally absent. There are, however, many exceptions to this rule, and the sputa are sometimes perfectly well characterized, and similar to those in ordinary pneumonia.

The general symptoms are more unlike those of ordinary inflammation: instead of the forcible pulse, and the active excitement of the capillaries, there is a feeble pulse, a diminished action in the smaller vessels, and a rapid sinking of the strength. In the worst cases the prostration is as great as in the typhoid varieties of fever, and the pneumonia is then frequently termed pneumonia typhoides. The epidemics of asthenic pneumonia are often of this character, and the disease is then extremely fatal. This is especially the case with the disease when it occurs among soldiers, who are much exposed to its causes. It also frequently assumes this form among the negroes in the Southern States. Gangrene of the lung sometimes supervenes in the third stage of this variety of pneumonia; and in these cases there is a close connection between the two affections, so that it is often extremely difficult to draw the dividing line between them, unless the gangrenous sputa should make the case clear.

The diagnosis of asthenic pneumonia is sometimes really a matter of no little difficulty, partly because the pectoral symptoms are of themselves comparatively obscure, partly in consequence of the delirium or coma so apt to supervene. Thus I have often seen persons not familiar with this disease mistake cases of the kind. They sometimes suppose them to be merely varieties of a low form of fever, or else a sub-inflammatory condition of the brain. The reason of this is, that the patient may very often scarcely either cough or expectorate; his respiration is, however, frequent, and besides that, the complexion, in whites, affords another indication of the disorder. That is, the countenance almost always has the dull, dusky hue already mentioned as frequent in

pneumonia. But the experienced eye is scarcely ever deceived, even at the first sight of a patient of this kind; neither the cerebral symptoms nor the prostration can disguise the case.

In our latitude this variety of disease is not common in every year, except in the aged, among whom it is very frequent. Sometimes, however, pneumonia in the majority of patients will assume a character approaching to this for a whole season—that is, the disease is less inflammatory than usual, and often is decidedly asthenic.

In the more Southern States it is very frequent in the winter and early spring, and occasionally proves to be a very fatal variety of disease, particularly among the black population. When they are taken with it, they sometimes scarcely cough, or show any other signs of disease, except excessive prostration, together with some nervous disturbance. These patients often accumulate in certain localities or certain portions of country, for the same district is not always equally troubled with the disease.

In one variety of it, occurring almost exclusively in the miasmatic portions of the country, the disorder frequently kills a large number of individuals whose constitutions have been broken down by intermittent or remittent fever. This latter form of disease is mainly confined to whites; but the asthenic pneumonia, as already mentioned, is even more common in negroes than among whites. In fact, it is one of that class of diseases of which patients of the African race die in great numbers, including, besides asthenic pneumonia, cholera, and in some localities dysentery and phthisis. Negroes, however, scarcely die, or indeed suffer very much from intermittent, remittent, or yellow fevers.

There is but one mode of satisfactorily ascertaining the existence of this disease, especially when it occurs in a black. Auscultation should always be carefully practiced, and it will be found that the bronchial respiration and cough occur as decidedly as they do in any of the ordinary forms of pneumonia.

The duration of this form is also much less prolonged than that of the ordinary variety. It sometimes proves fatal at the end of two or three days—not often at an earlier period. But, as a general rule, it may be said to kill at the end of six or seven days; occasionally, however, it is quite as prolonged as ordinary cases of pneumonia.

The prognosis of this variety is vastly more unfavorable than that of ordinary pneumonia. My impression is, that the number of fatal cases will sometimes amount to as large a proportion as one-half; but, as a general rule, about one case in every three or four may be expected to die in ordinary epidemics of this disorder. I find that most physicians in the South agree in speaking of the excessive mortality of this variety when badly treated, and even of its great danger under the most careful management.

The treatment of asthenic pneumonia is a matter of much difficulty; general bleeding is almost never borne with advantage, and in most cases it is directly contra-indicated by the exhaustion of the patient; cupping or leeching is very often of benefit, and in all cases it is easy to try the effects of a small local abstraction of blood, and to abstain from it if its effects should be injurious; in general, this kind of depletion, if borne well, is in such cases of decided benefit. If either the local abstraction of blood should not be tolerated, or the disease should continue but little improved after the patient has been cupped, blisters must be applied; they are much more certain in their action than in ordinary pneumonia, and may be used much earlier. The blister often requires to be reapplied if the part should heal very soon, or a new one may be placed over an adjacent part of the thorax. Other contra-irritants, such as sinapisms, are of more benefit as general stimulants to the nervous system, than as revulsives against the pneumonia.

Cupping, as a depletory remedy in all cases of disease of the chest, is vastly better than leeching. The quantity of blood can be accurately measured, while the cups act to a certain degree as revulsives. In asthenic pneumonia, however, I am accustomed to use this remedy only at the very beginning. A few cups then, placed over the seat of inflammation so as to take away a moderate quantity of blood, are very often of benefit; if they act well, it is easy to repeat them, but the repetition even of local bleeding should be resorted to with caution in this variety. For patients very often are unable to bear even the local abstraction of blood except in very moderate quantities.

The internal remedies demand more attention—it is often very difficult to determine upon their administration. They must be

prescribed and again discontinued, according to the state of the patient's strength, and the degree of the oppression under which he suffers. Antimony should, as a general rule, be forbidden; but there are some cases in which the inflammatory action is acute enough to justify a recourse to this remedy—that is, in small doses; in large quantities it is always dangerous. The time for its administration must be carefully chosen. It should never be given if there is much sweating, or a small and feeble pulse. The combination of opium, calomel, and ipecacuanha is much more frequently prescribed, and, as a general rule, it answers well. The dose may be varied in this form of the disease, just as it is in the advanced stages of ordinary pneumonia; and the opium should be given in minute proportions, not exceeding one grain, or at most a grain and a half, in twenty-four hours. In a considerable number of cases, I exclude the opium altogether—that is, if there should be much oppression and difficulty of expectoration.

The stimulating expectorants, and in some cases even wine or stronger stimulants, are useful, and even necessary, in this disorder. The senega and eupatorium may be given at first nearly in the same doses as in the third stage of ordinary pneumonia; but they are, in some cases, tolerated for a very short period before it becomes necessary to substitute for them the milder alcoholic preparations, with some nutritious food—that is, either wine-whey, or, in a few extreme cases, milk-punch, must be given freely.

The use of alcoholic preparations, such as wine or even more powerful stimulants, is more frequently imperatively demanded in this than in other forms of pneumonia. Some patients are sufficiently stimulated by means of wine, either in the form of whey or given alone, in the quantity of from half a pint to a pint in the twenty-four hours; others require it in considerably large doses. When, however, I find the patient not readily brought up by wine in moderate quantities, I am accustomed to substitute for it either brandy or whisky, generally in the form of milk-punch; the dose of this it is of course impossible to state with accuracy, as it must depend upon the form of the disease, and in some degree upon the previous habits of the individual. But, at all events, patients

should take stimulants in sufficient quantities to neutralize the prostrating effects of this disorder, and in that way to offer the best chance of restoration to health.

In the form of pneumonia which occurs in persons of intemperate habits, and is nearly always asthenic, alcoholic stimulants are often indispensable; this is especially the case if the inflammation should be complicated with delirium tremens. If stimulants be omitted in this class of individuals, the mortality of the disease will be very great; but if they be combined with local depletion and blistering, the inflammation will be relieved, while the nervous asthenia which is so apt to occur in these persons may be prevented.

Carbonate of ammonia is another remedy which is often of extreme importance in this disorder; it is peculiarly adapted to those cases in which the secretion into the tubes is considerable, and the patient expectorates with difficulty. It may often be combined with small doses of ether, or Hoffman's anodyne. The usual dose is five grains of carbonate of ammonia, and from twenty to fifty drops of the ethereal preparation, every two hours; when the depression is very great, the medicine may for a short time be given even in larger doses, or more frequently repeated.

After carbonate of ammonia has been administered for two or three days, I either lessen the quantity, or discontinue it altogether; for after it has been used for a certain period, its stimulating properties are in a great measure lost; and it acts mainly as an irritant to the stomach, often exciting nausea and vomiting.

Asthenic pneumonia sometimes prevails as an epidemic, and is attended with so much prostration of strength and alteration of the blood, that it has received the name of typhoid pneumonia, or even of typhus fever. These cases require more decided stimulation than those of the same variety in which the inflammatory symptoms predominate over the general feebleness, and will often scarcely bear even the local abstraction of blood. Blisters, with stimulating expectorants, especially ammonia, and often wine or other alcoholic preparations, become necessary.

LOBULAR PNEUMONIA, OR PNEUMONIA OF YOUNG CHILDREN.

These terms are used as nearly synonymous, although lobular pneumonia is not strictly confined to children. It is, however, much more frequent in them than in adults, and occurs from the period of birth to the age of seven or eight years—sometimes, though much more rarely, in older subjects. I have even seen the disease in adults. It differs from the ordinary pneumonia both in its progress and pathological conditions. Instead of the disease occurring in one lung, and in a limited portion of the tissue, it is scattered over a large extent, and throughout both lungs, and attacks isolated lobules, leaving for a time the intermediate tissue in a healthy state; these inflamed lobules become more and more numerous, until the greater part of the parenchyma is gradually consolidated. It is this progress of the disease which gives to it the term lobular pneumonia; the lobules affected are chiefly at the posterior part of the lung, for the gravitation of the blood toward this portion seems to favor the development of the disease in its cellular structure.

The appearance of the inflamed tissue is different from that of ordinary pneumonia; it is much darker, harder, smoother, and imperfectly granulated; it rarely presents the characters of the third stage, passing with difficulty to purulent secretion. The pleura covering the hardened tissue is sometimes but not often inflamed, and if but few lobules are attacked, there is little or no accompanying pleurisy. There are many cases indeed in which the disease is hardly inflammatory, the lungs becoming passively congested, and of a deep-red or brown color. This is especially the case when the children have been long very feeble, or have labored under another disease before the pneumonia begins. The disease is rarely confined to a single lung; both are almost always attacked, but the right lung at an earlier period and to a greater degree than the left. The bronchial tubes are much more frequently inflamed than the pleuræ; they contain the usual viscid mucus of the bronchitis of children.

In one variety of the disease, above referred to, occurring in very young children, the disorder differs somewhat from true in-

flammation; for in the variety alluded to there is a hardening of scattered lobules of the lung; the color, however, is not red, but blue or bluish red. The tissue, too, when cut, is smoother even than in ordinary lobular pheumonia. This variety of the disease is so closely allied to true lobular pneumonia that it often passes into it; but in itself it is not really of an inflammatory nature. It results simply from an imperfect circulation of the blood, causing local congestions. The true or ordinary pneumonia of children is actually a disease of an inflammatory character, although the grade of the inflammation is often comparatively low.

The portions of the lung affected in true lobular pneumonia are almost always the posterior parts, including both the upper and the lower lobes. The color of the lung is at first mottled, one portion remaining nearly of the natural hue, while an adjoining lobule is indurated and of course has some shade of redness. Both lungs are affected nearly equally; this fact of itself shows that it is not at first a true inflammation, but that it belongs rather to the class of congestions, inflammation often occurring at a secondary stage. In other cases, however, the disorder is from its commencement inflammatory, and we then find very nearly the same pathological lesions as in ordinary pneumonia. That is, the division of these varieties of pneumonia is not, in fact, marked by a broad line of distinction, the boundaries of one being confounded with those of the other, especially in the case of older children.

The extent of it in young children is sometimes enormous; I have certainly seen, in a child about two years of age, at least two-thirds of the mass of the lungs completely indurated, the respiration being performed by the remaining third.

When a portion of the indurated lung in this disease is cut out and thrown into water it often floats; this results from some of the vesicles remaining pervious to the air. But when a large portion of the lung is affected, it will sink to the bottom, just as it would do in the ordinary varieties of the disease; the air being as completely expelled from the affected part of the lung in the one case as in the other.

The affection of the bronchial tubes is often the first step in the series of diseased actions constituting lobular pneumonia, and

the induration of the lungs follows at various periods of time after the commencement of the bronchitis. The induration then appears first at the posterior portion of the lungs, and surrounds the smaller and more numerous tubes; it thence advances gradually toward the anterior part. In other cases the induration of the lung takes place very rapidly, after the impression of cold or some other cause of pulmonary congestion. The difference in the mode of attack naturally establishes two varieties of lobular pneumonia: one is acute and primary, the other more chronic, or at least less acute, and secondary to bronchitis or to some general disorder of the economy.

In either case the symptoms of the disease are nearly the same. The physical signs are at first merely those of the ordinary bronchitis of children; that is, a subcrepitant or mucous rhonchus, the percussion remaining at first clear, but gradually becoming dull as the disease advances. The dullness is not confined to one side of the chest, as in ordinary pneumonia, but is nearly equal on both sides; hence it is difficult to draw the line of distinction between the slightly dull sound and that yielded by a healthy lung. The only method of doing this is to fix in the mind a correct idea of the average sound yielded by the healthy chest in children of the age of the patient, and then to institute the comparison. The dullness does not, in the majority of cases, pass into complete flatness, for there is rarely a perfect consolidation of the parenchyma. The respiration is also in most cases not completely bronchial, for the same reason that the percussion does not often become perfectly flat; but it approaches this character more and more nearly as the disease advances, and sometimes becomes so to a very decided degree. Previously to reaching this stage, however, it assumes several intermediate changes, becoming gradually harsh and incomplete.

The other signs of this affection do not differ from those of ordinary bronchitis of children; there is in both cases cough, but no expectoration, and the dyspnœa gradually increases as the disease advances from point to point of the lung. There is fever, which is sometimes intense; and the disturbance of the circulation extends to the capillaries, which are much congested, especially those of the face, where the redness is in the early stages of the

disease extremely marked, forming circumscribed patches on each cheek. This peculiar color, with the dilatation of the nostrils caused by the dyspnœa, forms one of the best indications of the disease.

The frequency of respiration in children affected with lobular pneumonia constitutes one of the most decided symptoms of the disease. I have known them to breathe as often as ninety times in the minute, or even more rapidly. In these cases there is intense dilatation of the nostrils, and the inspiration is often heard at a distance from the patient. In less severe cases, the respiration is less frequent; but scarcely any child has the disorder to any degree of severity without breathing as often as forty or fifty times in the minute.

The cry and the cough are both rendered short and comparatively feeble by the dyspnœa, which of course prevents the child from taking a full inspiration.

The accidental symptoms are those connected with the abdomen and the brain; these are, from their nature, very variable. There is almost always more or less disturbance of the digestive functions; sometimes vomiting, and either diarrhœa or constipation. The very irregularity of these symptoms proves their little importance for the diagnosis, and that they are only of value in the prognosis of the disorder. The cerebral symptoms are more constant; the obstruction to the circulation necessarily produces congestion of the brain, which is shown by decided stupor. In bad cases this passes into coma, or even active delirium. Now, if these cerebral symptoms become extremely severe, they may to a great extent conceal the pectoral signs; for cerebral disorder produces, as its inevitable consequence, a more or less complete obliteration of the symptoms of other organs, or at least it causes a decided diminution of them.

There are of course no sputa in this disorder, children never spitting, although they do expectorate matter coming from the chest, which is immediately swallowed. Hence the only true way of seeing the expectoration of the child is after it has vomited; a large quantity of matter, really derived from the bronchial tubes, will then be found mixed with the contents of the stomach. In this variety of disease, the matter consists of a white or transpa-

rent mucus, sometimes becoming yellowish toward the last; it has rarely the aspect, however, of the expectoration in the second stage of ordinary pneumonia.

The diagnosis of this disease is obvious enough from the symptoms which I have described, excepting in one respect. As it arises insensibly during the course of bronchitis, there is no precise dividing line between the two disorders. In practice this is of but little moment, for when these diseases approach so nearly, they generally require a treatment which differs but little. There is also a difficulty as regards the diagnosis with one other disease—that of tubercles in the lung; these begin in children nearly in the same way as lobular pneumonia, and the local as well as the strictly physical signs are similar. At first they cannot always be distinguished with entire certainty; but, after a short period, the softening of the tuberculous matter will render the distinction very clear.

The prognosis in this variety of pneumonia is, as a general rule, favorable in its early stages; and, indeed, in all cases where it occurs as an acute disease, but is not from the commencement sufficiently severe to cause extreme dyspnœa. In those cases which are strictly secondary, and succeed to chronic—exhausting diseases—the enfeebled state of the patient's health renders the probability of recovery much less. Under all circumstances the disease is attended with more danger than ordinary acute pneumonia, which is very rarely fatal in children more advanced in age, in whom it often occurs.

The *treatment* of lobular pneumonia varies according to the manner in which the disorder commences. If it begin as an acute disease, with much oppression, and other evidences of high excitement from the beginning, it may require active treatment—that is, venesection in a few cases, and very frequently a few leeches, or, still better, a cup or two to the chest; these remedies are not, however, in most cases imperatively necessary, but they relieve the patient more rapidly and certainly than any other. Bloodletting, in any form, is to be avoided, as a general rule, in cases of the lobular pneumonia of children; and it is only in those stages of inflammation in which the natural secretory efforts of the system seem to be insufficient for its relief that it should be

resorted to. The external revulsive remedies are to a certain extent useful in this form of pneumonia, but are less so than in the same disease as it occurs in adults; hence blisters and other depletory revulsives, although they do relieve, are rarely of benefit until the advanced stages of the pneumonia, and even then are uncertain. Revulsives that act upon a larger surface, and at the same time are slightly stimulating, are much better: such as large mustard poultices. These should be applied not only to the thorax, but also to the lower extremities, especially to the soles of the feet and ankles. A convenient way of making them is to soak thick pieces of bread in hot vinegar, and to sprinkle them with mustard. In the declining stage, or in the milder forms of the disorder, a simple onion or garlic poultice is an excellent application.

The natural cure of lobular pneumonia is, like that of bronchitis, by secretion from the bronchial membrane; hence, in mild cases of the disease, nothing more is required than to prevent everything that may have an injurious influence, with the use of a few simple remedies, which may favor the natural tendency to bronchial secretion. These are the wine of ipecacuanha, graduated so as to keep just within the point of exciting much nausea, either given alone or with a slightly stimulating expectorant; of these, one of the best and most simple is the domestic sirup of onions, or the lac assafœtidæ. If the mucus becomes very abundant in the bronchial tubes, it will often much relieve the patient to increase the ipecacuanha to a dose sufficient to produce vomiting. There is, however, in general, little difficulty on that score; for the tendency to vomiting is in these cases so great that very small doses of ipecacuanha will excite it, or it may occur spontaneously. Vomiting is of course to be avoided if the congestion of the lung should extend over a large portion of the parenchyma.

Tartar emetic may be substituted for ipecacuanha if there is much fever; but it is not, as a general rule, equal to this remedy, nor is it as safe. Still, there is no important objection to it, provided it be given in small doses to produce a secretory rather than a contra-stimulant effect. The other expectorants, to which I have alluded under the head of bronchitis, are often advisable

in lobular pneumonia; but the rules for their employment present nothing remarkable.

There is a hygienic precaution which is essential both in acute and chronic lobular pneumonia: the child should never be allowed to remain long upon its back, nor, if the disease be severe, should it be permitted to sleep more than half an hour at a time. If this be neglected, the congestion of the lungs is greatly favored, and the disease may prove unexpectedly fatal. The child should be gently carried about, or allowed to sit up in bed, or be simply inclined a little toward one side or the other.

It is evident, therefore, that lobular pneumonia differs chiefly from the ordinary disease in its seat, and in its frequently assuming more of the congestive than inflammatory form. But there are some exceptions to this when the circulation is excited, and decided depletory means are indicated.

This precaution is of the utmost importance in the management of this variety of disease; the mechanical congestion of the lungs is so much increased by carelessly allowing the child to remain constantly upon its back, that many children die in consequence of it. The circulation through the lungs of children is so easily impeded by a prolonged dorsal decubitus in any disorder, that lobular pneumonia is exceedingly apt to be induced by it. This fact of itself shows that the disorder is not always inflammatory, but often belongs to the class of simple congestions.

PNEUMONIA OF THE AGED, AND LATENT PNEUMONIA.

In old age, as in early childhood, pneumonia assumes certain peculiar characters, but in the former case it approaches more nearly to particular stages of ordinary pneumonia. The only important difference is the great tendency of the disease to become latent—that is, to lose the ordinary functional signs of the acute inflammation, and to offer merely the feebleness and prostration which occur in most severe diseases, with little cough and little or no expectoration. Hence the disease is often scarcely suspected, and in a number of cases it is not recognized unless the obscurity of the general symptoms and the dusky purple tint of the face should lead the physician to explore the chest.

This disorder is one of no small consequence, from its frequency and degree of fatality among old people. No other disorder is so common a cause of death in them. It prevails especially in the spring, or when the winter happens to be exceedingly changeable; it also generally accompanies severe epidemics of influenza; and it is from this cause that the mortality in the latter disease sometimes arises.

The physical signs of it, bronchial respiration and the like, are quite as distinct as in other varieties of the disease. Cough, however, is exceedingly slight in almost every instance, and the expectoration is often scanty.

When the disease is not strictly latent, it is never so well marked by the ordinary pectoral symptoms as in more vigorous individuals, and passes rapidly through the first and second stages to suppuration. This peculiarity leaves little room, or at least but a short space of time for antiphlogistic treatment, and obliges us to resort at a comparatively early period to the more stimulating remedies which are appropriated to the third stage. At the commencement, however, the antiphlogistic treatment is directly indicated, and may sometimes be pushed with nearly the same vigor as in younger persons; but the period for this is short, and often from the first hardly discernible.

SECONDARY AND INTERCURRENT PNEUMONIA.

Pneumonia is naturally enough of common occurrence as a sequel to many diseases of the lungs, especially bronchitis and consumption. In the former case the original disease is in a great degree absorbed by the more severe but secondary affection; but in the latter the inflammation will go through its stages, and leaves the tubercles nearly as they were at the first. This is, however, not always the case; even if the tubercles are not advanced, their progress is occasionally hastened by the pneumonia, and after an attack of this kind we often find that gurgling or crackling is heard when there was merely a slight bronchial respiration previously to the pneumonia. In more advanced cases the pneumonia is not unfrequently the immediate cause of death by invading the portions of the lungs which remained free from tubercles,

and were therefore essential for respiration. The inflammation may also form an exciting cause of new tubercles in a portion of the lung of a consumptive, or may give rise to them in one previously free from them, but of a tuberculous predisposition. In this case the gray granulations are found thickly disseminated through the part most inflamed, and are evidently of recent origin. If there be not, however, a strong tendency to this disease, pneumonia has less influence in developing tubercles than pleurisy, notwithstanding there seems to be a more natural connection between the former disease and phthisis.

There is nothing peculiar in the management of these complicated cases, except that they bear a less decided antiphlogistic treatment than pure pneumonia, and mercurials must be used more sparingly. The rules for their management are essentially the same as those which I have already laid down.

CHAPTER XII.

GANGRENE OF THE LUNGS—PATHOLOGICAL LESIONS—SYMPTOMS—CAUSES—DIAGNOSIS—TREATMENT.

GANGRENE of the lungs is a disease which, though not very frequently met with, is of no little danger to the patient. This, like gangrene in other parts of the body, may occur either as a primary or secondary affection. When primary, it is probably owing to an alteration in the condition of the blood, which being rendered unfit for nutrition can no longer support the vitality of the parts. It occurs as a secondary affection in cases of asthenic pneumonia.

The anatomical characters of the gangrene are nearly the same in both forms, although when it is in its secondary form the tissue is at first hard and congested, and is seated in the midst of an inflamed parenchyma, while, in the primary form, it is at first merely infiltrated with a thin serous liquid, which is evidently an exudation depending upon the incipient gangrene, and gives rise to the fetor of the breath met with even in the first stage of the affection.

In the second stage the tissue begins to break down, and gangrenous matter is expectorated; next the bronchial tubes slough off, and nothing is left in a sound state but the vessels; these resist the destructive process for a long time; and on examination after death they are usually seen traversing the cavity; however, after awhile, they too are destroyed, and their destruction sometimes gives rise to a hemorrhage which kills the patient, although generally the blood has ceased to circulate through them before they slough, and little or no hemorrhage ensues. The sputa and breath in this stage of the disease are pathognomonic; they are both exceedingly fetid, and the disease can thus be easily distin-

guished from any other. There are two principal varieties of the gangrenous sputa: one consists of a dark thin liquid, which somewhat resembles tobacco-juice, or the infusion of licorice, occasionally containing small pieces of black, gangrenous lung; the other consists of a grayish-yellow pasty fluid, which is probably a mixture of pus and gangrenous liquid. The latter occurs most frequently in cases following pneumonia; both, however, are extremely fetid, though the odor differs slightly. In some stages of phthisis the sputa may occasionally resemble the second variety, and it is probable that in these cases the tuberculous portion of the lung becomes gangrenous.

The third stage begins with the formation of a cavity, which continues to increase for some time, and may go so far as to involve a lobe, or even nearly the whole of one lung. After the formation of the cavity, the sputa are nearly the same as they were before, consisting of a thin, fetid liquid, frequently stained with blood, which flows from the sphacelated vessels. When the case terminates fatally, the sputa increase in quantity, and the patient gradually sinks until he is completely exhausted, and death ensues. But when the disease terminates favorably, the following changes take place: the gangrenous portion of the lung is first circumscribed by a membrane which separates it from the surrounding healthy tissue. When the gangrenous part sloughs away, this membrane is left as a lining to the cavity, and secretes pus; therefore, we find the latter fluid at first mixed with the gangrenous sputa, and supplanting it entirely when the whole of the diseased portion has been removed. As the inflammation subsides, the membrane assumes the character of a mucous membrane, and at last becomes similar to that lining the smaller tubes and air-vesicles, resembling very closely the serous membranes in the delicacy of its texture.

If the cavity ceases to communicate with the bronchi, the lining membrane, being no longer exposed to the stimulus of the air, loses its mucous character entirely, and we then find a cyst lined with a membrane which is almost serous and nearly similar to that found in the brain and elsewhere after cicatrization; this may continue during the remainder of the existence of the individual, or be gradually obliterated by the formation of cellular

tissue. After the entire cure of the gangrene the whole tissue which was involved in the disease becomes more or less dense, and contains less than the natural proportion of air.

The portions of the lung immediately adjacent to the seat of gangrene are often nearly solidified. In many cases this induration is the result of a true pneumonia; the color of the lung, however, being somewhat less red than in the ordinary cases of this inflammation. Sometimes the inflammation is consecutive to the gangrene, at other times it has preceded it. Inflammation always occurs in the bronchial and serous membranes in the same manner as in ordinary pneumonia.

The portions of the lung affected vary very much. The most frequent seat of gangrene is, however, about the upper part of the lower lobe. This, too, is in some respects the most favorable locality, free expectoration taking place more easily than from any other part of the organ, and in that way preventing the retention of the liquid, which is especially apt to occur at the base of the lung.

Symptoms. The local symptoms of this disease are the cough, expectoration, and fetor of breath. The cough at first resembles that of ordinary catarrh, but as the disease advances it becomes looser and paroxysmal in its character, a change which is produced by the accumulation of fluid in the bronchial tubes requiring a violent effort to throw it off. The effort ceases as soon as this is accomplished, and the paroxysm does not recur until a fresh secretion again renders its discharge necessary. These fits of coughing are often extremely distressing to the patient.

The expectoration in gangrene of the lungs has been already alluded to; it consists at first of very little else than that which is found in ordinary bronchitis, or sometimes even in pneumonia, when this disease has preceded the gangrene. After the disease is thoroughly developed, then the characteristic sputa which have been described are formed; but the thin and offensive liquid is often mixed with another portion, which consists of little else than ordinary muco-purulent matter. Generally, however, this has more of a dull-whitish tint, in place of the decided yellow color of pus. These sputa are often exceedingly abundant; I have seen them amount to more than a quart in the day; the quantity is generally, however, from half a pint to a pint.

When the disease declines, the character of the sputa gradually changes; the fetor is insensibly lessened, and the gangrenous character of the expectoration at last totally disappears. When these changes occur, we are apt to infer that the disease is about to terminate in recovery; pus remaining mixed with the mucus until the cavity, instead of offering a pus-secreting tissue, is lined only with a mucous membrane.

The expectoration, even in cases of gangrene which have terminated in recovery, gradually becomes more and more mucous and transparent; and if there has been a large excavation, the patient usually continues to cough and expectorate for awhile, sometimes even permanently. This takes place only when the cavities are very large.

The fetor, both of the breath and of the expectoration, is most intense and characteristic in gangrene of the lungs. It varies, however, both in degree and in quality. When the gangrene is very rapid, and the cavities are quickly formed, the fetor becomes so great that it is scarcely possible for any one to endure the presence of the patient in the room. In other cases, the gangrenous odor is not very distinct except after fits of coughing, when it always becomes intense.

The sputa, when discharged, always retain much of the gangrenous odor; but this again varies very much, being sometimes intense, sometimes again comparatively moderate. But in no case should a large quantity be retained in the spitting-cup.

The *physical signs* are, in the first stage, feeble respiration and a moist rhonchus, generally either the mucous or subcrepitant; the percussion is either natural or a little dull. The signs are not, therefore, characteristic.

As the disease advances we find the usual signs of a cavity, viz.: cavernous respiration, a loose gurgling and cavernous resonance of the voice, or pectoriloquy; the last, however, is not so clear as in phthisis, unless the cavity should be large and near the surface of the lung, for the quantity of liquid in the cavity, and the softness of its parietes, deaden the resonance. When cicatrization takes place, we find merely feebleness of respiration, sometimes with a trace of cavernous or bronchial respiration; this gradually diminishes, but does not altogether disappear even after

the patient entirely recovers. In a remarkable case which I attended some years ago, the respiratory murmur became nearly as clear as in health after the patient had been for nine months perfectly restored, but for a long time previously it had remained feeble, and more or less bronchial. If the liquid is discharged from the cavity in its early stages, the cavernous respiration and attendant pectoriloquy are rendered much clearer, but they are generally less loud than in cases of pulmonary phthisis.

The general symptoms are the following: There is usually considerable fever during the progress of the disease, with a small, frequent, irritable pulse; sometimes the pulse is exceedingly feeble. The fever is only important as it is connected with the prognosis, which is very unfavorable when the fever is high, and the gangrene is advancing; but if the disease does not make much progress, the fever is less severe. There is an almost complete loss of appetite, produced by the nauseating character of the gangrenous liquid which is swallowed by the patient, who often has diarrhœa from the same cause. The skin is pale, and usually lead-colored in the advanced stage, as is observed in almost all cases of gangrene, whatever part of the body may be affected. Very often there is extreme dyspnœa, especially if the gangrene be extensive or complicated with pneumonia.

Prognosis. As an average result, about one-half of those attacked will die. In hospitals the mortality is rather greater, amounting to three-fifths, while in private practice it is probably about two-fifths.

Diagnosis. The only pathognomonic characters of gangrene are the fetid breath and expectoration of the patient. When these occur as an acute disorder, or supervene suddenly upon a chronic one, they are quite characteristic of the disease. If they occur slowly, and continue for a long period, they may depend upon a vitiated secretion of the bronchial membrane, caused by chronic bronchitis; this either never occurs in acute inflammations of the lungs, or is so rare as not to be taken into the account. Numerous as are the cases of gangrene which I have met with in hospital practice, I do not recollect a case in which the fetid sputa came from simple acute bronchitis. The other signs of the disease are common to it and some other affections of

the lungs; but the rapidity of the softening, and the formation of a large cavity in a short period, occur so seldom except from gangrene, that these signs are very good indications of the disorder.

Causes. The proximate, and at times mainly predisposing cause of this affection, is an altered condition of the blood; it becomes thin, and probably is vitiated in some unknown manner, which frequently coincides with a local inflammation. The ultimate causes are intemperance, indulgence in food of an innutritious nature, and any circumstances which break down the strength of the patient and thus predispose to gangrene. An attack of some acute disease, most frequently pneumonia, is the immediate exciting cause in rather more than half the cases; in others, the disease is in its origin a general one, and arises from the fluids alone; that is, from such an alteration of these as tend to gangrene. Gangrene of the lungs at times follows that of other parts of the body, and is then strictly a secondary disease; this is especially the case with that which occasionally follows surgical injuries or operations.

Treatment. This is not in most cases antiphlogistic, but supporting in its character—tonics and stimulants being required. When we detect the occurrence of gangrene, we must use all the means in our power to support the strength of the patient, who is in a short time very much prostrated. For this purpose stimulants and tonics are required, with the free use of porter, wine, and nutritious food. There is a remedy, however, which I have used in addition, and, I think, with some benefit, viz., chlorine; I give from ten to twenty drops of the solution of the chlorine of soda every three or four hours; if, however, there is disposition to diarrhœa in the patient, he will bear very little of it. In addition to the internal use of chlorine, I place near the patient's bed vessels containing chloride of lime, which add much to the comfort of the patient and his attendants. Opium is necessary in some cases of gangrene of the lungs to check the violent paroxysms which return so frequently as to fatigue the patient extremely; but it should be given sparingly, for it has the disadvantage of checking the secretions of the lungs; hence it should be administered in the smallest possible quantity, and even then may be combined with senega and ipecacuanha, unless the nausea should

be excessive. Blisters should be applied in those cases in which the gangrenous action is developed by a portion of the lung which has been inflamed; and in some ordinary cases, in which the inflammation is more decided than usual, we may also apply cups to the chest in addition to the general treatment of gangrene. We must, however, as a general rule, abstain from all blood-letting when gangrene of the lung occurs, except in those cases in which the gangrene follows inflammation, and seems to be in part at least caused by it. We may then occasionally use local bleeding, but it must always be with very great caution.

The indications for the treatment of gangrene of the lungs are, therefore, extremely simple; a generous, supporting diet and treatment, with blisters, and, in a few cases, cupping to the chest, to check the intercurrent and accompanying inflammation, constitute our main reliance, but the chances of success are greatly increased by the accessory remedies, some of which I have mentioned. The absolute antiphlogistic treatment is decidedly bad; and of the remedies which are classed under this head, none is more positively mischievous than mercury and its various preparations.

Alcoholic stimulants, such as porter, wine, or even brandy, are almost demanded in the treatment of gangrene. These remedies should be given in quantities almost as large as the patient can bear without inconvenience. Drunkards require large quantities of brandy and wine; those who have been intemperate will often take a bottle or two of porter, and some wine or brandy, in this disease, without feeling the slightest stimulant effect from them. These remedies should be continued throughout the whole course of the disease; good and nourishing food, of the kind most agreeable to the patient, should be given freely.

CHAPTER XIII.

TUBERCULOUS PHTHISIS—NATURE OF THE DISEASE—ANATOMICAL CHARACTERS—MODE OF ATTACK—CAUSES—SYMPTOMS—PHYSICAL SIGNS—DIAGNOSIS—PROGNOSIS—TREATMENT.

TUBERCULOUS PHTHISIS, or consumption of the lungs, is the most formidable disease of the thorax; that is, a much greater number of individuals fall victims to it than to any other affection. It is natural, therefore, that we should study the disease with attention, and we should strive to acquire the means of detecting it in that early stage when treatment is often of decided benefit. In the later stages, unfortunately, we do not possess the means of arresting the progress of the disease; it is certainly possible, to some extent, to modify the symptoms, and thus alleviate the sufferings of the patient, but we can only in a few cases contribute to positive recovery. Even in these few instances we do not possess the same controlling influence as in many other diseases, but must limit ourselves to acting strictly as the handmaids of nature, and aiding the process of cure which she institutes. It is possible that our power of control will be greater when the intimate pathology of the disease is more thoroughly understood, and the circumstances which favor the formation of tuberculous matter are completely known; but at present we are too often obliged to confess that our art is comparatively powerless in arresting so fatal a disease as pulmonary consumption.

Consumption of the lungs is frequently regarded merely as a local disorder, but although the chief lesions are seated in the pulmonary organs, the essential characters of the disease depend much more upon its diffusion through the whole body than upon the local mischief, which is often comparatively slight. The cause of the fatal termination is sometimes to be found in the local

lesions, and the secondary exhaustion and irritation caused by them; and at other times in the general disorder which attends both the earlier and later stages of pulmonary consumption.

Tubercular consumption is not confined to the human race; it occurs also among animals, especially in those who have changed their whole habits of living, and are reduced to a quiet and as it were sedentary life, in place of an active one. Thus the whole race of monkeys and apes, which approaches most nearly to man, is particularly exposed to pulmonary consumption; this being the usual termination of their life when they are placed in confinement, and leave their natural climate in the tropics for a colder one. Tubercular consumption is also extremely common in sheep and other classes of animals; less so, however, I believe, among the carnivorous races than among the herbivorous. The circumstances of an entire change of climate, as well as change of life, cause it to be particularly prevalent among the monkey tribe. Thus it is very evident that tubercular consumption is a common mode of death among all animals; and it is our object to inquire what peculiarities of life most dispose to it, and what means exist most capable of obviating it or of checking its development.

Consumption is to a great extent a complex disorder, and must be regarded in two distinct points of view; which must be kept steadily in mind, not only in the diagnosis, but the treatment of the disease. On the one hand, there is a local mischief which is often accompanied with inflammatory symptoms; and on the other, there is a vicious or diseased action going on in the whole economy, which is brought especially into play in the lungs, but is rarely confined to these organs. This diseased condition of the whole body has received different names; by some it is called the tuberculous diathesis or cachexia, and by others the scrofulous constitution; but when the latent mischief is brought into action, it then receives a name from the organ which is most decidedly attacked, and the original predisposition is almost lost sight of.

The tuberculous diathesis—that is, the general disorder, may therefore be developed to a very intense degree, and the local mischief may be slight, and tubercles may be scattered over a large number of organs. In these cases it is difficult to say whether the disease should be called pulmonary phthisis or not,

for the disease of the lungs scarcely preponderates over that of the rest of the body, and the seat of the disorder is to be looked for in the fluids rather than in the solid tissues. At most, the affection of the lungs is important in such cases as a sign of the general disorder, not as a disease in itself; and the only means we possess of modifying the progress of the affection consist in such remedies as are essentially general in their nature.

In other cases the pulmonary affection either begins as the earliest point of the disorder, or it occurs very early in the disease; and the functional disturbance of the lungs becomes so considerable that it necessarily attracts a large share of attention. This is the case in a large proportion of tuberculous diseases, especially among adults, in whom the lungs are not only the part which in most cases is earliest attacked, but it is that which is most deeply affected, and becomes the seat of the most extensive lesion. Just in proportion to the early appearance of these lesions, and to their inflammatory character, does the disease participate more in the characters of a local, and less in those of a general disorder; still the latter part of the affection must in no case be lost sight of. Even in those cases which are most inflammatory, and which differ least from pneumonia, there is something more than a common inflammation; for a secretion of tuberculous matter is added to the ordinary products of inflammation, and this secretion implies a peculiarity of constitution, either congenital or acquired, in the patient. If this peculiarity did not exist, it would be an ordinary local disease, which it evidently is not, either as regards its symptoms or lesions.

The essential character, then, of pulmonary consumption is, that tuberculous matter should be deposited in the lungs, and the disease may begin with the local mischief, or this may take place as an evident sequel to the constitutional disorder. But in both these varieties the constitutional mischief is present, and the evidence of this consists in mainly in the formation of the tuberculous matter. It is very clear, however, that the mere presence of tubercles does not constitute the disease, and we must avoid falling into an error into which the exclusive study of pathological anatomy might lead us. The disease is essentially a morbid condition which either precedes for a long time the formation of

tubercle, or it is more acute in its character, and is then accompanied or quickly followed by this product; the local diseases which often precede tuberculous formations being, as we have often seen, merely an exciting cause of them.

It is now agreed to restrict the term consumption of the lungs to the cases in which there are tubercles, although it was at one time used as synonymous with all chronic diseases of the lungs attended with emaciation, which of course included chronic bronchitis as well as chronic pleurisy.

Tubercle is the same in all its essential characters, in whatever part of the body it may be formed. It consists of a white opake or yellowish substance, which increases to a moderate size, rarely larger than that of a large almond, and generally much smaller when it begins to soften, not in the middle but near the sides, and is finally converted into a very thick pasty yellowish liquid, of a dull yellow color, and a heavy but not fetid smell. As soon as this softening takes place, the delicate cellular membrane, which always incloses tubercle like other morbid products of an analogous kind, begins to assume the characters of a pus-secreting membrane, and becomes thicker; ulceration of some portion of it finally takes place, and the matter finds its way toward the exterior of the body, generally by means of a mucous tube, if such should be in connection with it.

If the tubercles should not be placed near a mucous membrane, they soften very slowly, and remain indurated for a long period; sometimes, however, they are broken down, and form local abscesses. But these very rarely break into any other tissues.

At first tubercles appear under two different forms—either that of a yellow opake granulation, or of a grayish semi-transparent one; in either case they are rounded, probably from the pressure of the adjoining tissues. In other cases the part affected is infiltrated with a grayish semi-transparent liquid, which does not at first reveal its peculiar structure; little by little the original tissue disappears, and it is gradually absorbed as the quantity of the new substance increases. This infiltrated tuberculous matter is not always of a grayish semi-transparent color; in some cases it is yellow and opake from the very commencement, but in the greater number it passes through the changes of color just

described; these are accompanied with a corresponding change in the intimate structure of tubercle; it becomes more granular, more fragile, and less perfectly animalized. But in both cases the essential constituents of tubercle are the same, consisting chiefly of albumen, with a small portion of the salts of lime. There is, therefore, nothing peculiar in the chemical composition of tubercle; its characters depend upon its tendency to increase and finally to soften, and on the diseased condition of the whole economy which is necessary to its production.

The gradual changes which occur in its structure give rise to peculiar symptoms which are secondary to the disease properly so called. Hence, in the study of tuberculous disease in general, but especially in that of the lung, we have two sets of symptoms, one being primitive, and the other secondary, and not directly so much connected with the disease as with its effects. The patient may perish from either cause.

Although in its regular progress tuberculous matter ends in softening, and in the formation of a pus-secreting cavity, this is not a necessary or invariable consequence. In many cases the tubercle ceases to increase after it has attained to a certain size, and becomes harder and drier; the earthy matter increases in quantity, and a calcareous mass is left in place of the tubercle, and is surrounded by a membrane; in such cases the secondary symptoms are either wanting, or are very slight.

In a smaller proportion of cases the tubercles do not even advance so far, but are actually absorbed; this fact is difficult to prove, because tubercles are not in their earliest stages susceptible of physical demonstration, but there is every reason to admit it, for patients who have labored under the decided symptoms of commencing phthisis have on the one hand recovered, and on the other hand they have passed into the more advanced stage of the disease.

We have, however, more direct proof of the curability of tubercle. That is the evidence derived from pathological examination, and of this there is no more striking illustration than the case of an eminent physician of this city, the late Dr. Parrish. It is well known that he regarded himself as laboring under pulmonary consumption at an early period of life; he recovered

vigorous health, lived to the age of sixty, and finally died of a disease of the kidneys. In his case there was undoubted evidence not merely of the previous existence of phthisis, but of its absolute cure. At the summit of each lung were cicatrices and deposits of calcareous matter, proving that some portion of the taberculous matter had passed to the state of softening, and that another portion had become dry and indurated. We learn from pathology that the more advanced tubercles are almost never met with, unless some gray granulations or incipient tubercles are found at the same time scattered among or around the larger tubercles; hence the inference is very conclusive, that the granulations had disappeared in those cases in which, although there are evident indications of the larger tubercles in the cicatrices and in the calcareous matter, no trace exists of the granulations. Their cure probably takes place by absorption.

Phthisis is therefore strictly a curable disease, notwithstanding that, in the majority of cases, it terminates fatally at an earlier or later period. This arises not so much from the effects of the first crop of tubercles as from the successive deposits of new ones in different parts of the lung, and indeed of the whole body, or rather from the accompanying fever and irritation. Hence a patient rarely dies of one attack of phthisis, except it be of a very acute form.

Anatomical characters. These have been already described to a certain extent. As they essentially consist in the deposit and formation of tubercles, little need be added. The most frequent variety of tubercle in the lungs is that which commences by gray or yellow granulations, and gradually passes into a more developed stage; but the infiltrated tubercle is also extremely common, although rarely found alone—that is, without the gray granulations. Both of these varieties begin at the summit of the lungs in the majority of cases, and are found with nearly equal frequency on the two sides.

In other cases the tubercles are formed in a different way—that is, at the middle or lower portion of the organ, and they then begin more frequently as the formed tubercle, without being preceded by the gray or yellow granulation; this is particularly the case where the general health of the patient is much vitiated, and

the fluids of the body are much altered. In the latter case the tuberculous matter is softer, and less perfectly eliminated; but it passes more rapidly through its course, and is therefore dependent upon a more severe form of the disease.

When tubercles are carefully examined in their initiatory stage, they are found in the form of minute points, scarcely visible to the naked eye. These points are sometimes surrounded by blood-vessels, showing that there is a true inflammatory action at the very outset. It is a question, however, whether this inflammation is not produced by the tubercles rather than a cause of them; my own impression decidedly is, that both these conditions are met with. Sometimes the tubercle follows upon inflammation—that is, the inflammatory action occurring in persons who are in imminence of tubercles produces their secretion. At other times tubercle is formed by a direct non-inflammatory secretory process, thus showing that inflammation, although it may cause the actual appearance of tubercles, is by no means the ultimate cause which develops them.

After the tubercles have attained a certain size, which is generally that of a very large pea, they begin to soften; but sometimes they reach a much larger size without the least apparent loss of consistence. The softening generally begins near the circumference and gradually passes to the center, until finally the softened mass is discharged through one of the nearest bronchial tubes. The cavity which is left is lined with a double membrane: one, the most internal, is soft and almost pultaceous in its consistence, and continues to secrete a thick, tenacious liquid; the other is external to this, and is not always readily demonstrable. In fact, it is scarcely a membrane, it is rather the tissue of the lung, which is paler and more indurated than the subjacent structure.

While the tubercles first formed begin to soften, there are in the surrounding parts of the lung other depositions of a similar kind, which gradually increase in size until they form masses from the gradual adhesion which takes place between them. These tubercles finally soften and discharge themselves into the cavity which was first formed, or through an adjacent bronchial tube. The new cavity becomes, little by little, merely a part of the one which was first formed—that is, the walls which separated them

one from the other become gradually absorbed until a partition no longer remains between them, and the new cavity then becomes a part of the old, which gradually increases in size. Sometimes, when the constitution of the patient is comparatively good, and there are but few depositions of tubercle in the rest of the body, the cavities, if they are confined to one lung, may attain a very large size, and not unfrequently will occupy the space of the whole upper lobe, and sometimes a large portion of the lower, before the death of the patient.

The exact seat of pulmonary tubercle is difficult to point out. In fact, it is not always the same. In some cases, especially one variety, the tuberculous matter is evidently found adherent to the mucous membrane of the bronchial tubes and small vesicles; but the gray granulations follow the usual rule upon this subject, and are formed in the cellular tissue of the lungs, as in that of the pia mater or the spleen, and are nourished by distinct vessels distributed to each granulation. These granulations as they enlarge press upon the neighboring vesicles, and gradually cause their atrophy, and finally give rise to absorption of the pulmonary tissue. The cysts are sometimes formed in the lungs, or in other organs, by the newly-developed cellular tissue around the tubercle; this gradually thickens as the softening advances, and, as I have already stated, when this is completed the cavity is then lined by a regular pus-secreting membrane.

The process of cicatrization is nearly the same as in other cases of cavities in the lungs; as soon as the specific tuberculous matter is completely discharged there remains merely an ordinary cyst, which either becomes continuous with the mucous membrane of the bronchi, or is filled up by the deposition of cellular tissue. The calcareous deposits result apparently from a change in the tuberculous matter, in which there is a gradual deposition of lime, while the more animalized portion is gradually absorbed.

The condition of the surrounding tissues is very various. If the case occur as a purely constitutional disorder without previous local inflammation, the tissue remains pervious to the air, and nearly healthy; but if the inflammation either precedes the formation of tubercle or follows its development, the neighboring tissue is indurated, and of many shades of color from a light

gray to a decidedly reddish tinge. At other times the tubercular matter is infiltrated through the pulmonary tissue, and gives rise to an appearance not very unlike that of inflammation. When the inflammation is of that kind which disposes to the formation of tubercle—that is, when it occurs in an individual laboring under a highly developed tuberculous diathesis, the granulations are scattered abundantly through the most inflamed portion of the tissue, which in these cases is often nearly similar to the local congestions, or lobular apoplexy, which occur in connection with metastatic abscess of the lung. As this variety of phthisis is not so frequent as those in which the inflammation is comparatively slight or doubtful, the appearance is by no means a very usual one: on the contrary, in most cases, the lung is vesicular, and respiration is carried on in the immediate vicinity of the tuberculous matter.

When pulmonary phthisis is much advanced, and the cavities have become very large, they are usually found in both lungs, but in varying degrees. Thus, we generally find on one side amphoric or very cavernous respiration and gurgling, while on the other there is merely a moderate cavity, indicated by slight pectoriloquy and crackling. Both lungs are not, however, usually affected in the same degree: one is almost always more diseased than the other; sometimes one is converted into a vast cavity, while the other contains merely a few scattered tubercles, which are usually much more abundant at the summit than at the bottom of the lungs.

Pneumonia frequently occurs around the tubercles, which seem sometimes to be an exciting cause of it; and almost always there is a secondary pleurisy developed in proportion to the tuberculous deposit—that is, when tubercles are the most numerous there are generally found strong pleuritic adhesions. In some cases, however, the inflammation of the pleura does not keep pace with the tuberculous disease of the lungs: these cases constitute one of the worst forms of the disease, as perforation of the lungs, and of course pneumothorax, are then apt to occur, from softening of tubercles situated just beneath the pleura.

There is another mode in which tubercles terminate, besides the formation of a cavity; and that is, by transformation into cal-

careous masses, and the absorption of their softer elements. The same change is also observed in other organs than the lungs, which become tuberculous, especially in the bronchial and mesenteric glands. In the lungs these bodies are most frequently met with in the chronic variety of phthisis, especially in that connected with a slow scrofulous tendency; sometimes they are discharged into the bronchial tubes, and expectorated. In these cases they appear in the form of granules of various size, from that of the head of a small pin to that of a large pea; they are sometimes hard, with ragged edges, at other times they are comparatively smooth. These granulations, when crushed with the finger, break up like any other mass of calcareous matter.

These bodies are generally met with in the more favorable cases of phthisis, and furnish us with a very fair illustration of one mode in which tubercle may get well. They are often seen in the lungs of persons who have labored under attacks of phthisis, but recovered, for many years before their death. I look upon them, therefore, as affording one proof of the absorption of tuberculous matter.

Tubercles, I believe, however, do not always pass through the stages above described. I have no doubt that they are sometimes absorbed, and disappear without leaving any trace behind them; but as a more common occurrence, they pass through the process of softening, and then leave cavities. When no new deposit of tubercular matter occurs, these cavities give rise to cicatrices, often well defined, at the apices of the lungs. These cicatrices are sometimes quite numerous; when they are cut into, the mass is seen to be composed of a dense tissue, not vesicular, and apparently striated; sometimes a cavity remains, but more frequently in very old cases this disappears entirely, the bronchial tubes passing, of their natural size or even a little enlarged, to one of these depressions, which in fact are cicatrices.

Besides the lungs the appendages of these organs are a common seat of the tuberculous deposit, particularly in those cases in which the disease is more general or diffused in its character. These are the serous tissues and the lymphatic glands at the root of the lungs, or, as they are called, bronchial glands. In children they are more frequently the place of deposit of tubercle

than the lungs themselves, and even in adults are a common seat of this formation, though to a less extent. But the pleuræ are more important as a seat of tubercle; these bodies are often deposited on the adherent surface of the membrane, causing little projections scattered abundantly over it; they are also very frequently formed in the thickness of the false membranes thrown out in the pleuræ. This subject belongs, however, more properly to the accompanying inflammations of phthisis.

Tubercles are of course not confined to the thoracic organs; on the contrary, I have shown, in the preliminary remarks, that the disease is eminently constitutional, and that, like all cachectic disorders, the development of the peculiar product in the organ primarily affected favors its formation in other parts; and, therefore, many organs suffer from the same cause. Of these complications the most frequent, and perhaps most important, is the formation of tubercles in the follicles of the intestinal canal. At least this is the most important consequence of advanced tuberculous disease of the lung, for although there are other diseases of the same kind in which the mischief is more considerable, they are not simple sequelæ of phthisis, but are earlier manifestations of tuberculous disease: the lungs generally remaining healthy until the other organs are attacked, or presenting but a few scattered tubercles, which develop themselves slowly. For a more full account of the relative frequency of tubercles, I must refer to Lebert's Pathological Anatomy, and Rokitanski's and Wedl's works on the same subject, in which the history of tubercle is treated at great length. It is, however, imperfect, because it is founded upon observations made by physicians who were studying chiefly a single variety of tuberculous disease, or at least did not extend their observations to a large enough number of subjects, or to a sufficient variety of age and condition.

In pulmonary phthisis there are numerous lesions of particular organs of the body which are to a great extent peculiar to the disease, although not entirely produced by the deposition of tuberculous matter. Sometimes these lesions prevent the full development of tubercles, and thus act as one of the causes of this morbid secretion; at other times they are strictly secondary,

and in a great degree caused by it. Some of these lesions are strictly dependent upon the formation of tubercles in various parts of the body, as the serous and mucous membranes, the spleen, liver, and in nearly every organ. Thus we find tuberculous pleurisy, peritonitis, and meningitis, sometimes arising during the course of a protracted tuberculous consumption; and at other times they form the first morbid alteration, and the disease is called commonly chronic pleurisy, or peritonitis, or acute hydrocephalus. At the same time we regard these affections as differing from pulmonary phthisis.

Sometimes these tuberculous diseases indeed occur in the course of pulmonary phthisis, and are then simply a lesion which is subsequent to this disease; but at other times they take place either in persons who are in perfect health, or who may have merely a slight deposit of tubercles in the lungs. Thus, tuberculous diseases are so closely connected with the inflammation of the organs in which they are situated that they may be readily mistaken for simple phlegmasiæ, from which their symptoms sometimes scarcely differ. At the same time the prognosis then becomes much more fatal than if it were a simple inflammatory disease.

Mode of attack. Pulmonary phthisis, like other forms of tuberculous diseases, occurs either as an acute or chronic affection. A certain number of symptoms are common to both varieties; but others are peculiar to each, or at least are so much modified that it is difficult at times to recognize the identity of the two affections. The acute disease is attended by much febrile excitement, and by the general characters of an inflammatory affection. Indeed, it is either connected with an ordinary inflammation, or the secretion of the tuberculous substance itself is but little different from that process by which the common products of inflammation are formed. In the chronic disorder the alteration is not of an inflammatory, or even of an active secretory kind; it is a slow change in the condition of the capillary vessels of the body.

Both the acute and chronic varieties may be attended with a local inflammatory action in the lungs, or may be almost entirely free from it. In the latter case, the lungs are merely involved

as a part of the general disorder which shows itself in these organs, from their structure being favorable to the tuberculous deposit. When the disease is complicated with local inflammation, this may precede, accompany, or follow the tuberculous secretion. In the acute variety, the inflammation generally attacks the serous membranes, and in the chronic, the mucous, although this is not always the case, for the inflammation of any tissue of the lung may be closely connected with the abnormal formation.

There has been much confusion of ideas on this subject from the great variety in the connection which often exists between inflammation and tubercle; this is very similar to the connection between the local disease and the general diathesis. Indeed, the complicating local disease is almost invariably of an inflammatory character, so that the question is at last almost narrowed down to this—is inflammation the cause of tubercles in the lungs, and we may also add of the body in the other organs, though this is not immediately connected with our subject? If we seek a reply to the naked question, we will be compelled to answer negatively; but if we modify it so as to apply it to those varying conditions which are continually occurring in the human body, it may be answered that it is one of the causes. That is, it will develop the disease very frequently in persons who present a strong tuberculous diathesis, and occasionally in those who do not. In the latter case especially, and to a certain extent in the former, it acts in two ways: it is a direct disturber of the lungs, and a depressing agent upon the whole system. When inflammation occurs in this way before tubercles are positively developed, it may act as a predisposing cause during its continuance, and the tuberculous affection then coincides with the inflammatory action, or it then may occur after the latter has terminated. It then acts chiefly as a disordering agent upon the general system, with a slight local determination of disease to the part. In the former case, the local action of the cause is the predominant one.

The inflammation of different tissues does not, as I have stated, exert an equal agency upon the development of tubercle. To understand this, we must analyze them separately.

1. First, of the serous membranes. Pleurisy is perhaps the most

active of all these inflammations. Like the others, it attacks individuals in good health, or laboring simply under a scrofulous diathesis—and tubercles are developed during the course of the inflammation, or soon afterwards—or it coincides with the rapid formation of tubercles, which are then usually formed at the same time in the pleura, the false membranes, and the lungs proper; or it may occur as a mere secondary inflammation after the tubercles are formed, or are even tolerably advanced; in the latter case the pleurisy is a healthy, or at least a preservative inflammation, designed to prevent perforation of the pleura. All these varieties may be properly classed under the head of tuberculous pleurisy.

The first variety is the most difficult to distinguish, because the disease does not at first differ from ordinary pleurisy, and the important complication may be overlooked. The signs of the pleurisy are either gradually mingled with those of the tuberculous disease, or at least they disappear when the symptoms of phthisis show themselves. In this case the pleuritic effusion is often extremely large, and the disease is then sometimes ascribed to the absorption of the empyema. The pus has undoubtedly an influence upon the formation of tubercles, but in most cases it acts merely as other causes of the disease—that is, by producing an irritating action upon the part, and a general depressing influence on the whole body. The second variety is that in which tubercles are formed at the same time, and apparently by the same morbid action as the ordinary products of inflammation. The pleurisy is readily recognized; but the tuberculous complication can only be distinguished by careful attention to its symptoms, and even then the diagnosis is but a probable one. In the last variety there is, of course, no difficulty in ascertaining the nature of the pleurisy.

2. Bronchitis and pneumonia occasionally occur among the earliest lesions in the acute forms of phthisis. The bronchitis is then of the common mucous kind, and rarely passes into tuberculous phthisis, except in those cases in which it is connected with a strongly-developed scrofulous diathesis. But the bronchial inflammation is extremely frequent as an early complication, coinciding with the first formation of tubercles, or following them.

In the latter case it is most marked in the tubes which run through the clusters of tubercles, and it is then nothing but the ordinary secondary bronchitis, which gradually increases as the disease advances, and is most intense when softening has taken place and the mucous membrane is irritated by the continual passage of the softened tubercles.

Pneumonia is the least frequent of those local inflammations which act as determining causes of acute tubercles; it is rarely of the frank sthenic kind, but generally occurs in scattered lobules, bearing a close analogy to the lobular pneumonia of young children, or the variety of inflammation which attends the formation of metastatic abscess; it is, of course, difficult in these cases to decide if the pneumonia is really antecedent to the tubercles, or occurs under the relation of a mere attendant, or even a secondary result.

In chronic cases of phthisis the preceding inflammation is often of the bronchial variety, a common chronic mucous catarrh passing by insensible shades into pulmonary phthisis—that is, a time arrives when the secretion of tuberculous matter takes place and the bronchitis is no longer simple. This is not, however, the only inflammation which proves a determining cause of the more chronic forms of phthisis; pleurisy not unfrequently produces a like result, especially in those cases where the effusion has been large. Pneumonia rarely produces the same result; indeed, this inflammation is, on the whole, remarkably independent of tubercle, except as a result of this disease.

Phthisis without local inflammation at the commencement. There is no doubt that many cases of phthisis, probably the larger number, originate without being preceded, or even at first accompanied, by local inflammation; when this occurs, it is strictly secondary to the tuberculous disease. These cases of the disease are sufficiently described in the commencement of this chapter, and in fact they do not differ from those of general or constitutional tuberculous disorder, except in the predominance of the affection of the lungs. They may therefore be latent for a considerable time, and only attract attention to the lungs when the disease is sufficiently advanced to produce some secondary inflammation. The principal symptoms of the disease are therefore

those of the general tuberculous affection, with or without the addition of the signs caused by the local mischief; these are not always developed sufficiently to attract much notice until the disease is quite decided. The mechanism of the pulmonary disorder, if such an expression can be used, merely consists in a direct secretion of tuberculous matter from the vessels, and it is sometimes connected with a diminished instead of an increased vascular action in the part, although this is not invariably the case even at first, and is very seldom so after the disease is developed.

Causes. When we remember the circumstances under which the disorder occurs, we may divide the causes of it into two classes —those of a general and those of a local character. The general causes are such as exist originally in the individual, or arise from the circumstances in which he is placed; the latter are those which may be to a great extent obviated by art, and the action of the former may thus be checked indirectly, or at least not favored. The local causes of phthisis are either directly inflammatory, or at least belong to morbid conditions which must be removed by medicinal rather than by hygienic measures. If the general causes include a hereditary predisposition to tuberculous disease, it is of course necessary to insist more strongly upon those that are accidental. We find these causes enumerated in the work of Dr. Clark, and in most others upon the subject, and it is not necessary to enter much into detail concerning them; some classification, however, may be adopted, to render the same intelligible.

1. We may place hereditary predisposition in the first instance. This is universally admitted, and the strength of it is increased if the parents were actually laboring under the formed disease at, or a short time previously to the birth of the child. It may descend from either parent, although it would seem that the mother exercises the greatest influence in this respect, especially if she nurses the child herself. The usual laws of hereditary transmission, however, hold good, and the probabilities of their action are increased if the child present the signs of the scrofulous temperament.

2. Depressing causes which debilitate the powers of life increase the tendency to the morbid action. These, of course, are

very numerous. Imperfect diet, exclusion from light and from fresh air, and mental depression, are among the most powerful. Inaction, or a diminished activity of body, favors the same result. These causes are very obvious in patients admitted into hospitals with other chronic diseases, and afterwards attacked by phthisis. It is always important to protect the patient from the influence of these causes, and, whenever practicable, the greatest attention should be paid to them. One of the advantages of a journey certainly arises from its invigorating influence and the abundant supply of healthful air which is thus obtained for the patient. The depressing causes often arise from the effects of a disease which is cured, but leaves the patient in an enfeebled state; this is often the case with typhoid fever; in other instances it produces a more direct impression and the phthisis supervenes before the fever entirely ceases.

3. Certain occupations are known by direct observation to favor the development of consumption; these are such as require a constrained position, and especially sedentary confinement in close rooms. Mineral or vegetable dust or powders diffused in the atmosphere contribute to the same result. Hence the propriety of changing the occupation of the patient is often a matter of strict necessity. Irregular exposure to cold and heat has a similar tendency, but it is much more effective as a cause of the accidental inflammations that often precede phthisis.

Although these are the chief of the general causes of phthisis, the list may be much extended; they are, however, more or less analogous in their character, and more or less directly depressing upon the individual.

Thus it is found that recent emigrants from Europe to other countries are often attacked with phthisis within a few years after their arrival. This is frequently the case in the United States, although their labor is better repaid, and of course their food is more nourishing than at home. We observe, however, that the frequency of phthisis varies a good deal according to the race of the individual. The Scotch and Scotch-Irish are more subject to phthisis than the true Irish or the English. Germans and Frenchmen are less subject to it. The blacks die of it in an immense proportion, particularly in the Northern States, and this is more

true of the intermediate races between white and black than of the true African stock. In the latter race the development of phthisis seems to depend more upon the climate than upon sedentary occupation; for very few are engaged in such employments as favor greatly the development of phthisis. It is also evident that mental depression does not act in this manner upon the blacks in northern climates, since this condition of mind is not produced by their usual habits and mode of life.

Symptoms. Phthisis is, or soon becomes, so complicated a disorder that a constant analysis is necessary in the study of the symptoms. If these are regarded in a crude, general way, they are often extremely indistinct; hence many writers upon the subject content themselves with the signs of the disease as fully established when diagnosis is no longer a matter of doubt, or they add to this the general characters which are usually described as designating the scrofulous temperament. But as the discoveries of Laennec prepared the way for a full understanding of the pathological characters of the advanced disease by a knowledge of the physical signs which attend them during life, physicians have not rested satisfied with this view of the subject, but have ascended, as it were, to the source of the affection, and have labored to point out the initial steps, or at least the symptoms which occur very early in the disorder. Still we find in many works on the subject, even of the most recent date, that the physical signs which occur sometimes quite late in the disease are brought forward as indicative of the earliest stage of the disorder, which in most cases they certainly are not.

We are obliged, therefore, to divide the symptoms into several different classes, which will lead us naturally to the study of the connected or dependent diseases. 1. First, we have a series of symptoms dependent upon the tubercular disease considered as a general disorder. 2. Symptoms connected necessarily with the development of tubercles in the lungs, including of course the physical signs of the disease, properly so called. 3. Symptoms dependent upon the accessory disease of the lungs and air-passages, including the larynx and trachea, which are present to a greater or less degree in nearly every case of the disease. 4. Symptoms of disorder of the organs, some of which depend

upon a deposit of tubercle in the tissue, but for the most part they are connected either with a positive inflammation or a mere functional disorder; to a greater or less extent these take place in most instances of phthisis. We do not, of course, expect to meet these symptoms in every case of the disease: many of them may be obscure, and some absent entirely; but we do in reality scarcely ever meet with a case in which they are all badly defined—that is, with a case of true latent phthisis. Cases in which the disease is so obscure as to be nearly latent are quite common.

1. *General symptoms common to phthisis and other tuberculous diseases.* These differ in the acute and chronic varieties in degree, and to a certain extent in nature. In the acute variety a rapid deposit of tuberculous matter takes place, generally throughout a number of organs at the same time; this approaches very nearly to an inflammatory secretion, and it is attended with a general disturbance of the body, which differs little from inflammatory fever, especially the fever which attends a subacute inflammation of the pleura or other serous membranes. The pulse is extremely frequent, generally from one hundred to one hundred and thirty in the minute, quick and jerking; these characters are often difficult to define, but are at the same time very well marked. The febrile excitement is continued, and does not cease during the twenty-four hours, diminishing a little in the morning and becoming more intense toward the middle of the day; at night there is almost always sweating, which at times is extremely profuse, and as a general rule is abundant. Patients, however, are not always willing to admit that they have profuse sweats, especially at night; at least not in the early stage of phthisis. This unwillingness arises chiefly from a great indisposition on the part of the patient to confess that they have any symptoms commonly ascribed to consumption. There are rarely distinct chills; generally a mere sensation of chilliness at irregular times, and differing therefore from the chills of well-defined hectic, which occur in the latter stages of phthisis.

The accessory symptoms, or those connected with the alimentary canal, are strictly such as would be supposed to exist in cases of high fever, such as thirst, anorexia, and constipation; but they are less severe than in most instances of febrile excite-

ment, because the stomach and bowels do not at all participate in the earlier disturbance of the system. The general appearance and countenance of the patient change when the fever is developed. The expression is restless; the lips and countenance pale and flushed at irregular times; the flush is often circumscribed when the fever is most considerable, but the tint is of a much lighter and at the same time a brighter red than in pneumonia. The flush is not peculiar to any one form of tuberculous fever, but occurs without reference to the part affected. Thus, it occurs in tubercular meningitis, pleurisy, and peritonitis; in these cases it is, however, generally less marked than in tuberculous disease of the lungs.

The countenance is often indicative of much dyspnœa, with dilatation of the nostrils, if there be a very large and rapid secretion of tubercles. The emaciation is rapid, partly as a direct effect of the tuberculous disorder, and partly from the profuse sweats which rapidly enfeeble the patient. Sometimes the emaciation occurs as the very first symptom of phthisis, and is afterwards followed by the fever and other signs of the disease. In some patients, however, there is not much emaciation, but simply a dusky or pallid hue of the complexion until the latter stages.

These signs, in themselves, although not positively pathognomonic of acute tuberculous disease, can scarcely occur in a high degree from any other cause. Although all cases of acute tuberculization are not necessarily attended with them in their highest degree, we will find that they exist to a greater or less extent in nearly every case, and that their value is much increased by the very slight development or entire absence of other lesions sufficient to account for the fever, especially if conjoined with one other character—that is, their persistence—for this fever does not rapidly decline; on the contrary, it usually lasts for a considerable period, and besides resists all treatment.

Pleurisy of a subacute character approaches very nearly to the febrile symptoms of acute phthisis, whether the pleurisy be complicated or not with tubercles; in fact, I have little doubt that the pathological condition of the economy which attends the formation of the lymph, and that of acute tuberculous disease, differ but very slightly from one another. This, however, is not

sustained by a course of demonstrative reasoning, and therefore is of little interest until it is better developed. Arguing by way of exclusion, we may attach great importance to the tuberculous fever, especially when it cannot be accounted for by the existence of any other disease capable of producing it.

In the mere chronic cases of phthisis the general signs of the disorder are more difficult to distinguish, because their development is slow and the fever in the early stages is comparatively unimportant. The signs which are most decided are those indicative of a deterioration of the constitution and of the nutrition. The skin of the patient is generally of a dull tint; or if his complexion be naturally very clear and the capillary circulation extremely active, the cheeks are from time to time flushed with a circumscribed redness, not very unlike that of acute phthisis, but less decided. At the same period, those peculiarities which are supposed to indicate a scrofulous or tuberculous constitution are often more developed—that is, the blueness of the conjunctiva, and the rounded fusiform appearance of the ends of the fingers, which, although not peculiar to this condition of things, is certainly more common then than under any other circumstances.

The moderately chronic cases are also accompanied with fever, which is often slight, and sometimes limited to a mere sensation of heat or burning at the palms of the hands and feet: the sensibility to cold is at the same time often much increased; but there is very rarely a distinct chill at the earlier stages, except from inflammatory complication.

In short, the ordinary cases of phthisis offer as symptoms—emaciation and slight fever, with an increase of the peculiarities designating either a constitutional diathesis or a tendency to the disease from an original feebleness of constitution. The very chronic cases are more and more obscure as regards the general symptoms in proportion as the disease is slower in development. The addition of local signs of irritation confirms the value of the more chronic constitutional symptoms, as well as of the acute, provided these local signs do not disappear very readily.

Hectic fever is a very frequent consequence of tuberculous disease after it has attained a certain stage of development—not that

the fever is peculiar to tubercles, but, on the contrary, it is common to all diseases attended with suppurating cavities communicating with the exterior. It scarcely occurs under other circumstances —that is, the true hectic; the fever of irritation, on the contrary, is very frequent when no suppuration exists, and is then very analogous to the initiatory fever of ordinary tuberculous disease, although it is less distinctly intermittent in its type. The true hectic occurs in the advanced stages of phthisis, when softening of tuberculous matter has taken place and a pus-secreting cavity is formed. It is characterized, as is well known, by a strong tendency to a regular paroxysmal character, which sometimes approaches closely to intermittent, by abundant sweats generally coming on at night, and by a pulse which is at least as frequent, but generally more compressible, than that of an earlier irritative fever.

In acute phthisis, as well as in the more chronic varieties, there is frequently developed a peculiar state of the nervous system; the patient is restless, and although conscious that he is laboring under a serious disorder, is often unwilling to admit it even to himself. He attempts to disguise his symptoms, or treats them as of but trifling moment; so that it is difficult to determine his real situation except by careful examination. This condition, of mind rather than of body, is however not always present; sometimes patients who are taken with phthisis are not in fact at all aware that they are laboring under a serious disease for a long period, when they are led to consult a physician from some accidental symptom. Thus the mode of commencement of the disorder assumes numerous types, differing a good deal in the order and development of the symptoms.

We may add to the general symptoms of phthisis the extreme exhaustion and tendency to œdema which occur in the latter stages of the disease. These, of course, are not peculiar to it; but they are developed naturally in all cases in which the patient is not prematurely cut off by the occurrence of some incidental mischief, such as severe diarrhœa, or loss of strength from inability to digest food.

2. *Symptoms directly dependent upon the development of tubercles in the lungs.* The bronchial or other inflammations which

occur very early in phthisis are not properly dependent upon this disorder if they precede it, but true secondary inflammation of the bronchial membrane is a necessary consequence of the tuberculous deposit, and is strictly consecutive to it. The signs of the inflammation are of course scarcely different from those of ordinary bronchitis, and have been sufficiently noticed already —that is, if we restrict the term bronchitis to those cases in which the inflammation extends over a large surface, and is in itself tolerably severe; but if the slightest cases of irritation of the tubes, in which a cough occurs very early in connection with tubercles, are to be regarded as instances of bronchitis, the symptoms are very different from those of ordinary catarrh. It is not possible to discriminate between the influence of the slight bronchial inflammation and of tubercles in the production of the cough.

I therefore class both these causes together, and regard the cough which occurs at the commencement of ordinary phthisis as the result of either or of both; this is at first very insignificant, and sometimes, though rarely, quite absent. At first it is much more frequent early in the morning than at any other period of the day, although we may find a great irregularity in this respect; it gradually increases in severity and in the frequency of its return, until at last it becomes severe and more or less paroxysmal. This occurs when cavities of some size have formed, and the liquid contained in them tends gradually to accumulate until it gives rise to a violent paroxysm of cough. In the latter stages of the disease the patient is often disturbed in the night, but especially toward morning, by the intensity of coughing, and he then relieves himself of accumulations of liquid sputa, which oppress his respiration sometimes to a very great degree. After he has expectorated, he again breathes with comparative ease for a time. In the last stages of the disease the cough becomes feeble and hollow, or cavernous in its character; a circumstance which is familiar to every one who has seen many cases of consumption.

In cases of phthisis, when the progress of the disorder is arrested, the cough gradually subsides, and sometimes entirely disappears, although the physical signs of the tuberculous depo-

sition continue. That is, the cough is either lessened or entirely gotten rid of, because there is no longer softened tuberculous matter pouring into the cavities and bronchial tubes, and the accompanying bronchitis has also nearly or quite disappeared. These periods of cessation of the acute symptoms of phthisis are frequently met with in chronic cases, and they may not appear again for a long time, until there is a new development of tubercle in the lungs. The degree of cough, however, in all cases of phthisis is very various; and though bearing a relation to the extent of the pulmonary lesion, is not always strictly proportioned to it; for cough, as is well known, is in many diseases a symptom depedent upon the nervous condition of the individual as well as upon the disease of the lungs.

The expectoration is of course nearly connected with the cough; at first it is, like the cough, very slight, and often insignificant, consisting of merely a little whitish or transparent mucus. After a time it becomes more and more abundant, and of the usual bronchitic character, for there is either no purulent matter, or this is so small in quantity as not to attract notice.

Sometimes, however, in the earlier stages of phthisis, when there is much bronchitis, there is an abundant secretion of purulent matter; but this has the ordinary appearance met with in cases of bronchial inflammation.

After the tubercles have begun to soften, pus is necessarily found in the sputa, and those are of a yellowish color, differing often in appearance from ordinary muco-purulent expectoration; for the softened tuberculous matter of which they are in great part composed is extremely viscid and different in appearance from pure pus. If the softening is very rapid, the quantity of the thick pasty substance often amounts to ten or twelve ounces in twenty-four hours. In general it is combined with more or less thin mucus, which is intermixed with the thick yellow matter. As soon as cavities form, the thicker, more purulent part of the sputa, which is retained in them, is molded into a rounded, irregular form, often with loose, cottony edges; these portions are suspended if they contain air, or if not, they fall to the bottom of the transparent mucus. This constitutes the nummular

sputa, which are not characteristic of phthisis in general, but only of one stage of it.

If the walls of the cavities become hard, and cease entirely, or in great part, to secrete purulent matter, the expectoration consists merely of a thin mucus, as the lining membrane does not in that case materially differ from that of the bronchial tubes. In the advanced stages of phthisis, and occasionally at a rather earlier period, when the strength of the patient is much enfeebled, the walls of the cavity may soften down rapidly, and fall into a fetid, thick, grayish liquid; this is nothing else than gangrene of a tissue partly filled with tuberculous matter.

The gradual obstruction of the lung by the deposited tubercle, and its removal by softening, renders so large a portion of the vesicles unfitted for purposes of respiration, that the dyspnœa is always considerable in the advanced stages of phthisis. In the earlier period, however, this will often occur to a greater or less extent, so that dyspnœa is very far from being a mere mechanical result of the obstruction, but is in part caused by the vital action going on in the lungs. It is most severe in acute phthisis, and sometimes is one of its most prominent symptoms.

Dyspnœa is also a common symptom when tuberculous disease is preceded by emphysema; a given amount of the deposit added to the dilated condition of the air-cells interfering sufficiently with the play of the lungs to cause great difficulty of respiration.

There is almost no pain from tubercles, properly so called; the uneasiness felt from time to time in the chest seems to depend entirely upon the accompanying inflammation. The local symptoms purely belonging to phthisis, with the exception of the cough and expectoration, are slight; but those belonging to the secondary inflammations are very numerous; even the cough and expectoration may be nearly absent, owing to causes which, in many cases, are not understood. We know, however, that the same causes which render other pectoral diseases latent act here—that is, the feebleness of the patient, and the diseased condition of the brain. Hence in lunatics we find that phthisis is always obscure, and sometimes scarcely betrayed by any local symptoms. They gradually emaciate, seem unwilling to stir about, and have very little pain; but the cough is very slight, and even sometimes apparently

absent altogether. So that in them one of the most frequent signs of phthisis is the diarrhœa, which is less developed than in chronic dysentery, but is still quite severe, and, together with the results of physical examination, will make the case evident.

Physical signs. These are among the most decided in advanced cases, but very obscure in the early periods of the disorder. We do not now refer to the signs of the concomitant inflammations, but to those of phthisis, properly so called—that is, to the signs of actual tubercular deposition. At first these occur at the summit of the lungs almost always, and are limited to the signs of mere obstruction; the vesicular inspiration is feeble, or harsh and slightly puerile, while the expiration is becoming louder and more prolonged. The character of the respiratory sound, therefore, gradually becomes rude, and at last approaches the bronchial respiration, in which it finally terminates as soon as the vesicular structure is completely replaced by the tuberculous matter.

This sign of the respiration must be sought for with much care in the early stages of phthisis. It is usually found earliest developed at the upper and posterior part of the right lung—where the natural structure of the bronchial tubes causes the normal character of the respiration to approach that of tuberculous disease. Still, it is necessary to be cautious in avoiding a too hasty conclusion as to the diagnosis; we must examine again and again until we are sure that the rude character of the respiration is decidedly developed and connected with the signs of percussion. When tubercle is developed at the upper portion of the left lung, it is not so easy to distinguish it in the forming stage as on the right; the left bronchial tubes are smaller than those on the other side, and the less close approach to rude respiration which exists there, naturally renders the evidence of the very earliest stage of phthisis more difficult to determine.

The bronchial respiration is more or less local, and is present chiefly at the summit of the lungs, both anteriorly and posteriorly, according to the quantity of tubercle, and the more or less obstruction of the larger bronchi themselves. It is, however, generally most perceptible at the posterior part of the chest, partly because the bronchial tubes are there larger than at the anterior part, and partly because the tubercles are most frequently depos-

ited first at the back parts of the lung around the larger bronchial tubes. If these latter remain uncompressed, the air of course passes freely through them, and the bronchial respiration may be tolerably loud; if, on the other hand, they are soon closed, the respiratory sounds are all feeble. Then the bronchial respiration may sometimes be not heard with any distinctness.

As soon as softening begins a slight rhonchus is heard, approaching more nearly to the subcrepitant than any other: this gradually passes into decided crackling, and finally into gurgling, as the liquid becomes more abundant, and the cavity increases in size. The crackling is not always constant, however; neither is the gurgling. Both these sounds may disappear when the liquids in the cavity are removed by expectoration. If the patient remains quiet for a time, without much cough, these signs may again be heard. The cavernous respiration and gurgling will both cease for awhile when the cavities are blocked up with a thick matter, but will again be developed as soon as the patient expectorates freely. The cavernous respiration is generally developed with the gurgling, and sometimes replaces or alternates with it.

The relative development of gurgling and cavernous respiration is influenced by many causes. As a general rule, both these signs are heard at the same time in the more advanced stages of phthisis. The gurgling, however, is not so persistent a sign of a cavity as the cavernous respiration, although it is often so loud as almost entirely to destroy all respiratory sound. I therefore consider gurgling, when cencentrated to a small space, as the usual sign of a cavity. The difficulty is to distinguish between the liquid which is agitated in a cavity from that which is merely contained in the large bronchial tubes. For there are cases in which a large tuberculous deposit occurs about the upper lobes of the lungs, and is at the same time traversed by large bronchial tubes containing an abundance of mucus. Hence the flat percussion and bronchophony are found coexisting with a very loose mucous rhonchus, which is sometimes concentrated enough to pass for a legitimate cavernous gurgling. The best way of distinguishing these cases is for an inexperienced auscultator not to content himself with a single examination; for by repeated examinations it will not be very difficult for him to distinguish between cases in which a real

cavity exists from those in which bronchial tubes filled with mucus pass through an indurated lung.

If a cavity is formed in the lung after the softening of tubercles, the cavernous respiration is heard most clearly when the cavity is emptied of its usual contents. That is, if the cavity be of small size; for if it is large, of course cavernous respiration is heard combined with gurgling, even in cases in which it may be half full of liquid. But in cases in which the size of the excavation is still but moderate, of course there is no cavernous respiration nor pectoriloquy when the cavity is filled up with fluid. It is therefore very common to meet with cases in which the cavernous respiration is heard one day and disappears the next, when the secretion of liquid into the cavity has proved abundant. These cases are at the summit of the lungs limited to the earlier stages of softened tubercle, but at the lower lobe of the lungs it is comparatively rare to find distinct cavernous respiration, simply from the fact that the cavities, except when of a very large size, are almost always more or less distended by the accumulation of purulent matter within them.

When tuberculous cavities have attained a very large size, the cavernous respiration necessarily becomes very loud and blowing. That is, it approaches in its character to the amphoric. I have already stated, when describing the signs of respiration, that true amphoric respiration is comparatively rare, for in fact most cases of what are termed amphoric respiration are merely an exaggerated degree of the cavernous sound. Still there are cases in which the genuine amphoric inspiration is heard. These cases are limited to very large cavities which communicate freely with the bronchial tubes. When the modification of the respiration just alluded to exists, there must be, of course, corresponding intonation of the voice, and very often there is also an exceedingly large and liquid gurgling. Amphoric respiration is generally most easily discovered at the upper lobe of the lungs, although sometimes it is very well characterized at the very base. Indeed, we may say that the sign is not so easily destroyed as cavernous respiration, as the air must freely pass into the cavity from its very large size.

All these signs of tubercle are comparatively difficult to verify

when the disease affects the lower lobes of the lungs; the air is less strongly driven into that portion of the pulmonary tissue, and the obstruction caused by the accumulation of matter, which is not easily expectorated, to a certain degree prevents or impedes the development of the signs of softening or cavities. Hence it is necessary to be aware of this fact, especially in the examination of children, in whom there are often softened tubercles in the lower lobes of the lung—not however constituting true cavities, unless the softened matter is thrown off. We may, therefore, say that the cavities in the lower lobes of the lung are often not recognized, simply from mechanical causes. They are really softened tubercles, but the softened matter is not sufficiently removed to allow them to be converted into cavities.

The signs of percussion properly belonging to phthisis are of course limited to those of induration of the parenchyma; they give us no information as to the progress or approach of softening. As the tubercles are generally most developed at the summit of the lungs, the dullness is early perceptible there; hence it may often be first detected by percussion above the clavicle, or upon, or immediately beneath it; and however slight the dullness may be, there is little difficulty in distinguishing it, if attention be paid to the natural degree of resonance, and the two sides be carefully compared together. The intercurrent inflammation may, of course, give rise to varying degrees of dullness, which may rapidly increase or diminish.

When the tubercles, as is often the case, are developed, especially at the posterior portion of the lungs, the first evidences of dullness on percussion are of course perceptible there. This, however, is often doubtful at first, particularly if the patient be not much emaciated, so as to give the greatest possible facility in percussion. Still, in any case in which the tubercles are at all agglomerated together, a very careful percussion at the upper and back part of the thorax will often enable us to detect a slight degree of dullness. It is very necessary in these cases, however, to percuss carefully—to strike lightly and equally on the two sides, giving a quick, short blow, which will render a faint degree of dullness perceptible, while it will not be severe enough to cause pain or uneasiness to the patient. In cases in which tubercles are

developed consecutively to pleurisy, there is often a considerable degree of dullness on the affected side. This dullness may sometimes be mistaken for that belonging exclusively to pleurisy, if the attention of the physician is not closely directed to the frequent connection of these two diseases. Then he may usually detect the share of dullness which depends upon the past pleurisy and that connected with the tubercles; for these are generally, though not invariably, deposited as usual at the upper portion of the lungs.

Any other intercurrent disease producing dullness on percussion may complicate phthisis. Thus pneumonia, when it occurs around tubercles, or, as is sometimes the case, takes place at the moment these bodies are formed in the lungs, it will of course give rise to a dull or flat percussion. This sign is then met with particularly in pneumonia attacking the upper lobes or the usual seat of the intercurrent inflammation. But in some cases in which pneumonia occurs in patients with a strong tuberculous diathesis, both the tubercles and the inflammation take place at the lower lobe of the lungs, producing in that way a variety of disease which may be readily mistaken. Tubercles, when they occur at the lower part of the lungs, are always detected with some difficulty. The sounds, on percussion, are to a great degree confounded with those due to the accompanying pleurisy or pneumonia; and it is only in cases in which the dullness is limited in extent, but decided in degree, that it can serve as a good indication of phthisis. Besides, when the tubercles have passed into the softening stage, they rarely form true cavities; since pus is constantly retained, mixed up with softened tuberculous matter in the excavations, so that these are very rarely emptied. When the cavities really become large, they are of course in a great degree freed from this liquid; and the signs proper to cavities exist. These cases however are not very common; but they are occasionally met with. Hemorrhage also, occurring so frequently in connection with phthisis, is sometimes immediately followed by an eruption of tuberculous matter into the portion of the lungs from which the blood has been discharged. In these cases we have, of course, dullness upon percussion developed to a greater degree than elsewhere in the part of the lung from which the blood has been extravasated.

When a large deposition of tubercles has occurred throughout the whole of the lung, especially when complicated, as it usually is, with pleurisy, the sounds on percussion become nearly or quite flat; the flatness however is not usually as perfect as in the second stage of pneumonia, for there are generally portions of the lung which still admit air. In cases in which the cavities become enormously large, we can sometimes detect by a strong percussion a muffled but at the same time an increased resonance, differing in character from that of the healthy lung, and not so loud. This increased resonance on percussion is produced mainly when the side of the thorax has not been much contracted by the mode in which the adhesions of the previous pleurisies have taken place. It is on the whole a sign which it is not desirable to produce; for it requires a stronger percussion against the thorax than is consistent with the comfort of the patient, or is willingly produced by one really conversant with this mode of examination. Therefore I am apt to conclude, when I observe any one attempting to produce this sound in large cavities, that the physician is but a novice, gratifying his own self-love at the expense of the comfort and welfare of the patient. I would never attempt thus to produce the *pôt felé* sound; remembering that I am tapping upon a human being, and not upon one of the lower animals.

In examining any patients whom we suspect to have phthisis, it is always necessary to remember that our blows should be very short and slight; for there is, in the first place, no necessity for a heavy blow, which really renders the sound less clear than a slighter one; besides, patients affected with phthisis often labor under a nervous apprehension, which is much increased by a violent blow, even if no pleuritic pain exists.

The comparative percussion of the two lungs is always necessary in suspected phthisis, because we never find the disease equally developed on both sides; one of them, which is least affected, is almost always clearer than the other, thus affording a good point of comparison. Still there are cases in which the tubercles are developed almost equally in both lungs; and if the disease is not far advanced, the difficulty of diagnosis is in some degree increased by this fact. On percussion we then find that the sounds are dull on both sides; while this dullness may some-

times be so slight as to be mistaken for the natural inequality met with in ordinary health.

When emphysema exists in connection with phthisis, the sounds on percussion are of course modified; emphysema rendering them preternaturally clear, while the tubercles of course would make them dull. This cause of difficulty is confined however to the earlier stages of phthisis; for when tubercles are sufficiently numerous to form even a small mass, the sounds of percussion become dull, notwithstanding the emphysema. This cause of confusion is not very common, as emphysematous patients are not very often attacked with phthisis; still it is sometimes a source of doubt in the earlier stages of tubercular development.

We should also carefully auscult the voice in cases of suspected phthisis. If the increased resonance of the voice be extremely slight and limited to the summit of the right lung, it is a sign of very little importance unless conjoined with other indications of the disease. But if it exists in the left side, or if it be conjoined with bronchial respiration and dullness of percussion, it is a valuable indication of phthisis. When the tubercles are deposited in a greater degree, the resonance of the voice becomes more evident and passes into bronchophony. In cases in which the cavities are formed, the resonance of the voice is gradually converted into pectoriloquy. The latter sign usually remains as a permanent symptom, but in some cases it becomes confused and less distinct; the loss of distinctness occurs when the voice becomes amphoric, as it sometimes does in very old cases of consumption.

The characters of the voice often furnish a good sign of the earlier stages of phthisis; but it must be always recollected that the resonance of it varies considerably according to certain conditions of the individual. Thus, when the natural voice is acute, the resonance is much greater than if it be on the bass key. Besides, the lower lobes of the lungs, when affected with phthisis, rarely give rise to pectoriloquy, although bronchophony may exist to a greater or less degree; this depends simply upon the fact that tubercular softening in the lower lobe does not often produce a real cavity. The constant passage of softened tuberculous matter into it tends to fill it up, and of course obscure its physical signs.

The examination of the voice, however, in all cases of phthisis, is looked upon as of much less importance than it was thought to be by Laennec. He was naturally led to attach greater value to it, from its being the initiatory step with him in the study of diseases of the lungs. The results of the examination of the voice are in fact included in those of respiration, which teach us the condition of the lungs in a more positive and satisfactory way.

The signs of percussion and auscultation are the most important, but in the course of the disease attention should be paid to the conformation of the thorax. The parietes of course contract when pleuritic adhesions have taken place; even if there are no adhesions, the consolidation of the lung produces a partial contraction of the tissue which causes a slight sinking of the ribs; the most sensible alteration of the conformation, however, is caused by the adhesions. This is most perceptible near the clavicles and behind them. The same causes render the ribs comparatively motionless in this situation, as the air enters imperfectly into the tissue which is hardened by the gradual deposit of tubercles.

It naturally occurs to every one that these signs are rather applicable to the advanced than to the early stages of the disorder; but there are generally some characters which afford a tolerably good indication of commencing phthisis as soon as a slight deposit has formed, or a partial infiltration of the tissue has taken place. These are not so much signs which are referable to any of the regular classes which I described at the early part of this treatise, as mere trivial alterations of the natural respiratory sounds, which become important from their position and the coincidence with them of the general symptoms of common phthisis; without these, the signs are of some value, although they may be of doubtful instruction. Thus, the commencement of rude respiration, which is denoted by a trifling increase of expiratory sound, especially if it is heard on the left side, and a harsh, rough, inspiratory murmur, which differs from the natural vesicular sound, are both important —that is, if they are combined with a slight dullness on an extremely careful percussion; always, however, with the proviso that the general symptoms should be in some degree developed, for I cannot repeat too often that the general signs are at the com-

mencement of the disease the most important. If the physical signs are met with in addition to them, a probable opinion may be converted into a certain one, which affords a good measure of the degree of the disorder; but if they are absent, the importance of the general signs is diminished, but not destroyed.

The physical signs of deposit and softening of tubercle extend gradually over the lungs, in proportion to the progress of the disorder, until a considerable portion of them may be involved. But the parts last affected do not offer as well-marked characters as those first attacked; hence the respiration in the parts which remain comparatively healthy becomes in a great degree supplementary and puerile; and even when tubercles have invaded them, the vesicles still dilate, and their peculiar murmur is loud and harsh, notwithstanding a certain number of them may have become impervious to the air.

The study of the respiration in the portions of the lungs least affected is important in phthisis. The air entering here always produces a puerile sound, which, when the attention of the observer is first directed to these parts, may sometimes lead him astray. Therefore the rule of examining the sounds both of healthy and of diseased structure, and of drawing conclusions from a comparison of the two, is always important in phthisis.

3. *Symptoms dependent upon the accessory disease of the lungs and air-passages, including larynx and trachea.* To a great extent the remarks relative to these affections have been already anticipated, from their necessary connection with the subjects previously treated of. Thus the secondary inflammation of the bronchi produces few symptoms differing from those of the tuberculous disease of the lungs: the bronchitis, however, may occasionally become acute, and then the rapid increase of the cough and dyspnœa, and the formation of the characteristic rhonchi, may establish the nature of the intercurrent affection. The sputa are often also increased in quantity, and become more transparent, like those of the earlier stages of ordinary bronchitis. Pneumonia too gives rise to increased dyspnœa and to more or less crepitus and roughness of respiration, with frequently a viscid transparent expectoration; but the bronchial respiration is much less loud than in ordinary pneumonia, and the increase of dyspnœa

is much less considerable than we might, a priori, suppose it to be. In other words, the chronic disease modifies the symptoms of the acute affection.

The secondary pleurisy is almost always of the dry kind. Effusion sometimes, however, takes place during more advanced stages of tuberculous disease, but this is rather an exception than a rule; the ordinary symptoms of the pleurisy are pains which vary from a mere stitch to a severe, sharp, lancinating pain, preventing the patient from lying on the affected side. The flying or wandering pains which are at times felt in the thorax during the course of phthisis are probably dependent upon the same pleuritic complication, although this is not perfectly certain.

The inflammation of the larynx and trachea has a much more important connection with phthisis. Chronic laryngitis is often called laryngeal phthisis, which is a sufficient proof that a close connection or a great similarity was supposed to exist between these diseases. When the affection of the larynx occurs late in phthisis, it is absolutely secondary, and results, in part at least, from the irritation of the sputa passing from the lungs over the larynx and trachea, and thus giving rise to inflammation and ulceration.

The form of chronic laryngitis which attracts most attention, however, is that in which the lesion of the larynx precedes the disease of the lungs, and for a long time appears totally independent of it. But after a time, which is very variable as to length, the signs of consolidation of the lungs are apt to supervene, and the case may then terminate in decided phthisis. From our knowledge of this frequent connection, we must be cautious of the prognosis of such cases. It is true that if the laryngitis can be arrested at a tolerably early stage, the patient will probably not become consumptive; but should it resist our efforts to cure, the disease almost always terminates in a tuberculous affection; this is the case both with the common and syphilitic varieties of chronic laryngitis. Of course the existence of a highly-developed tuberculous diathesis greatly enhances the danger of the case, and under these circumstances the laryngitis is sometimes little else than the commencement of the morbid phenomena.

The same remarks apply to chronic trachitis, except that it is

a more obscure affection, not connected with a special function, like the larynx. The symptoms are generally mere cough, with an obscure sensation of tickling or soreness above and immediately below the upper margin of the sternum; while those of the laryngitis, in addition to the sensation of irritation, are hoarseness, gradually passing into aphonia. The trachitis is less important in itself than the laryngitis, unless there be some evidence of general tuberculous disorder, when it is quite as grave. Like the laryngitis, it should be removed as soon as possible.

The disease known by the name of chronic pharyngitis, or sometimes "clergyman's sore-throat," is occasionally connected with phthisis. But the connection is rather an accidental than a fixed one, for the disorder consists essentially in an inflammation of the fauces, including the uvula and tonsils. It is certainly rather more apt to occur in individuals who offer the characters of the scrofulous diathesis than in others; and it has apparently some agency in favoring the development of phthisis in these patients. It is often complicated with a chronic inflammation of the larger bronchial tubes.

4. *Symptoms of other organs than those of respiration.* The symptoms of the diseases of other organs than those immediately connected with the lungs are very numerous in the different periods of pulmonary consumption. Indeed, every disease which produces so deep an impression on the whole economy must of necessity give rise to many functional disorders in the different stages of its progress; and, on the other hand, those local affections will often determine the development of phthisis by the operation of the general laws which we have already laid down as to the connection of tuberculous disease with the enfeebled condition of the body, which is readily brought about by the action of a local affection.

When these local symptoms precede phthisis, they are not in most cases dependent upon the development of tubercle; when they occur during the course of the disease they are more frequently the indirect symptoms of the growth and progress of this morbid body, but in the majority of instances this is not the case. The proper way of stating the subject is this: 1. In some cases of tuberculous disease the morbid product is developed in

different organs of the body to a sufficient degree to cause its proper symptoms, while the proportion of the tuberculous matter in the lungs is still so much greater than in other viscera, that the specific designation, pulmonary consumption, is retained; in most of these cases the tubercles in the different viscera are developed at a later period than those of the lung; in a few, the former precede the latter. 2. The accompanying disorders and symptoms of other organs than the lungs may have no immediate connection with the growth of tubercles. These symptoms are extremely numerous, and occur either previously to phthisis, or in its various stages.

The symptoms of tuberculous disorder of the organs of the body other than the lungs cannot be distinguished from those of ordinary chronic inflammation; indeed, the two affections are often united, and occur together. This is particularly the case in the serous membranes—that is, the pia mater, pleuræ, and peritoneum. The inflammation is in these cases of a slow, subacute variety, and we recognize the tuberculous complication chiefly from its persistence and slow progress. In the intestines the symptoms of the tuberculous disease of the follicles are essentially intermittent at first, and they vary incessantly, diarrhœa often occurring for several days, and then being followed by constipation; after a certain time the diarrhœa may entirely cease, and the follicles, which have been frequently the seat of the tuberculous deposition, will cicatrize. There are no other cases of tuberculous deposit in mucous membranes in which we can recognize its symptoms.

In the serous membranes it is essentially connected with inflammation, and the symptoms are therefore inflammatory, but generally of the subacute kind. All the varieties of these disorders are closely allied together, and constitute the tuberculous disease of serous membranes which may take place before any tubercles are formed in the lungs, but in the majority of cases they occur in adults during the progress of pulmonary phthisis. In other cases of tuberculous deposit than those just mentioned, the lesion is attended with symptoms of functional disorder of the organs attacked, in proportion as it produces a positive destruction of the tissue, or as it is accompanied with inflammatory action. We

see, therefore, that the tuberculous deposit of itself gives rise to few local symptoms, except it is so situated as to disturb the function of an organ.

Of the tuberculous lesions of serous membranes the most interesting in children is tuberculous meningitis, a disease not formerly looked upon as connected with phthisis, but now known to be a simple variety of tuberculous disease. It is, sometimes, but rarely, found in adults, and then it generally occurs in confirmed cases of phthisis; but children often show no signs of tuberculous disease until meningitis is developed.

The other lesions, and the attending symptoms which occur in phthisis, or sometimes even before tubercles are actually formed, are extremely numerous, and very various in character. They are sometimes prominent enough to attract attention almost exclusively to them, and they obscure the characters of the most important infection. Of this nature is dyspepsia, which is a very frequent though extremely irregular symptom. In some cases it occurs very early in the disorder, and may appear before there is either positive or probable evidence of tuberculous formation; but there are cases of dyspeptic phthisis in which the disorder of the stomach appears often to be quite independent of either general or local tuberculous disease.

In other cases the gastric disturbance is evident before the local disorder, and is clearly connected with the loss of appetite; it may give rise to phthisis in one of two ways—either by the febrile excitement which it causes when the disease assumes an acute form, or by the alteration of the fluids which produces a peculiar action of the mucous membrane, and gives rise to a slow softening and destruction of it. The complication of dyspepsia and phthisis constitutes one of the worst forms of consumption; as long as the digestive functions are unimpaired the disease is slow in its progress, and attended with little suffering to the patient; but if the nutrition fails it becomes much more acute.

The intestinal canal is subject to many derangements; the natural effort of the disorder, like most febrile affections, is to produce constipation; but diarrhœa may occur not only from the formation and softening of tubercles, which have been already mentioned, but from the usual causes of inflammation. In most

cases the symptoms do not differ from those of the same disease when they occur in a less complicated form; but those of the pulmonary affection are singularly modified, the cough frequently subsides, and the disease is apparently much better. The inflammation of the bowels then acts like any other revulsive action. The cough is again increased as soon as the diarrhœa subsides.

Fistula in ano is another affection closely connected with the alimentary canal. Dr. Louis came to the conclusion that this was a rare complication in phthisis, but his conclusions are based upon peculiar data: on examining all the phthisical patients who entered the wards of a hospital, he found that fistula in ano was extremely rare. If he had examined, on the other hand, all cases of fistula in ano admitted into a surgical ward, he would have found that a large portion of them end in phthisis, either during the continuance of the fistula or after it has been healed by a surgical operation. As a general rule, cases of consumption complicated with fistula are quite slow in their course, and they are most frequent in men who are advanced to the middle period of life. These cases of fistula ought very rarely to be treated by a surgical operation. I have often thought that I was rendering an important service to patients by preventing them from allowing industrious surgeons to tamper with cases of the kind mentioned.

The affections of the liver are frequent in phthisis, especially in women, particularly the young. The most frequent of them is the fatty degeneration of the liver, which is rare except in phthisis of women and in drunkards. Why these two conditions should both give rise to the same, or nearly the same alteration, is extremely difficult to explain. The functions of the liver are but moderately impaired, notwithstanding a large portion of its tissue is converted into fat. There is another disease of the liver which occasionally occurs in phthisis, or rather just before the tubercles are developed, which is more important than the fatty state—that is, cirrhosis. This disorder is most frequent when phthisis occurs in countries where intermittents are endemic, and therefore it is often difficult to distinguish the precise time when tubercles are formed. The only mode is to attend carefully to

the local indications of disease of the lungs, especially to the physical signs.

I am compelled to group together the secondary lesions of phthisis and their symptoms, otherwise this subject would be extended to too great a length. Condensed as this view is, however, some of these secondary alterations must be omitted, for the very sufficient reason that a disease of great duration, pervading the whole economy, and causing much febrile excitement, necessarily gives rise to nervous and irregular secondary lesions. Hence we often find that the phthisical patient complains of severe pains in the bones or muscles, which appear to have no necessary connection with the disease, but belong to the class of unexplained sympathies.

There is another disease which has certain relations with phthisis, viz., diabetes. The most usual mode of fatal termination of this disease, especially when it is chronic, is by the supervention of an intractable form of pulmonary phthisis. Patients, after laboring under diabetes for a long period, begin to cough, emaciate more rapidly, and, upon an examination of the chest, tubercular deposition is found to have occurred, which generally proves speedily fatal. It would seem that the diabetes develops the phthisis, by breaking down the whole economy, and in that way favoring the deposition of tubercles.

Insanity is a disorder of the nervous system in which phthisis is a frequent termination. But I am disposed to think that this in most cases depends rather upon the inactive life and depressed mental state of insane patients than upon any necessary connection between the two diseases. At any rate, however, the coincidence of these affections must excite a great degree of interest among those in charge of insane hospitals.

Diagnosis. The diagnosis of phthisis is not attended with any difficulty in advanced or even in early cases, provided they are regular, and the symptoms follow their usual order. But in cases in which the local signs are not well developed, or the symptoms connected with other organs predominate over those of the lungs, the subject is much more difficult; and we are then obliged to resort to two modes of diagnosis. One is to group together carefully the symptoms we observe, and then to compare with these

groups different diseases which might possibly give rise to similar symptoms. Thus, any two or three of those symptoms which I have just described as belonging to the lungs, with the addition of emaciation and the febrile movement so frequent in commencing tubercles, would render it probable that the case was one of incipient phthisis. It is true that a complete diagnosis cannot always be made until the disease has advanced far enough to betray some of its essential physical characters, but this is not the case in the majority of patients.

There are certain other signs which are of great value in the diagnosis of early phthisis. These are either individual symptoms, or peculiar groups of collective signs, which would singly be of little value. The most important of them is, perhaps, hæmoptysis.

This symptom receives different degrees of attention; some writers consider it almost pathognomonic of phthisis, while others attach comparatively little importance to it. There is, however, little difficulty in reconciling these conflicting opinions; and if we examine the facts relative to it under several points of view, but little real difference of opinion remains. Hæmoptysis, however, is not necessarily connected with tuberculous disease of the lungs. It may arise as a consequence of disease of the heart, in which the lungs become engorged with blood, and relieve themselves by hemorrhage, or it may arise in women as an effect of suppressed menstruation. Besides these cases, it sometimes though rarely happens that a flow of blood takes place from the lungs, without any such obvious cause, and without an apparent connection with tubercles. The latter cases it must be supposed are quite rare, so that hæmoptysis is still, in the large proportion of patients, a symptom of formed or commencing consumption.

We may state, in general terms, that at least two-thirds of all who have hæmoptysis are actually affected with consumption, or are on the point of becoming so. The proportion of cases in which this connection exists was stated by Andral to be two-thirds among women, and four-fifths among men; and from my own observation, I am induced to concur very closely with him. But even when consumption follows an attack of hæmoptysis, it is not always the most fatal form of the disorder; a number of such

cases occur in daily practice. Among them I would cite the case of a physician of Philadelphia, who had frequently repeated attacks of hæmoptysis, with other symptoms of consumption; from them he however recovered, and now enjoys good health, and is able to attend to the fatigues of an extensive practice. The first of these attacks was more than thirty years ago.

Hæmoptysis occurs in three different relations to phthisis: First, before tubercles are developed; second, when they are still crude, and perhaps few in number; third, when cavities are formed. In the first two cases, the blood is evidently exuded from the mucous membrane of the smaller tubes, and probably from the vesicular structure; in the third, it comes in most cases from vessels which pass through the bands running across cavities; these may finally give way to ulceration before their caliber is completely obliterated, and a large, and even fatal hemorrhage, may suddenly occur.

Hæmoptysis is of little value as a diagnostic character, unless abundant—that is, exceeding a wineglassful in twenty-four hours; a discharge of blood from the lungs in less quantities will, to a certain extent, indicate a tendency to tuberculous disease of these organs, but it is not in itself of much importance. If the hemorrhage be more abundant, and occur without any obvious cause, it must always be regarded as a sign of commencing phthisis, or at least of a peculiar condition of the lung itself, or of its capillaries, which often ends in tuberculous formation. The evidence in favor of this conclusion is extremely strong, and is not refuted by the fact that a number of patients affected with hemorrhage recover; for the first stages of phthisis are by no means incurable; and the varieties in which hæmoptysis occurs are among the most favorable. These cases of exemption from phthisis after abundant hæmoptysis are not extremely numerous, as any one may ascertain for himself by simply interrogating individuals who have arrived at the middle periods of life, and enjoy good health: of these a very small proportion have ever had hæmoptysis; and this is true not only with reference to healthy individuals, but as compared with the whole number of phthisical patients; among the latter the proportion of cases of hemorrhage is very large.

The occurrence of tuberculous pleurisy, or even the long con-

tinuance or frequent repetition of the simple disease, is another indication of phthisis which will strengthen the diagnosis derived from the more direct symptoms of the disorder.

I have therefore been long in the habit of carefully looking at all patients who may have labored under an attack of pleurisy sufficiently acute to demand the attention of a physician. In these cases, it is true that it is often difficult to decide whether tubercles are not at first coincident with the pleurisy. This is undoubtedly the case in many instances; an eruption of tubercles takes place at the very time when the pleurisy commences, and the symptoms of one disease are to a great degree masked by those of the other. This is the affection commonly known as tuberculous pleurisy; but a matter which is of much more importance is the fact that even simple pleurisy, when severe enough to have produced decided symptoms, leaves behind it, in many cases, a strong disposition to tubercle. These bodies are then most frequently deposited in the lung the pleura of which was affected.

The time at which phthisis occurs consecutively to pleurisy is very variable. It most frequently takes place just at the close of the inflammation, while the patient is still weakened; the febrile movement of the pleurisy then increases, and phthisis supervenes upon it. At other times we find that the pleurisy has ended in perfect recovery, but at the expiration of a few months, perhaps even years, such patients are taken with the regular symptoms of phthisis.

We must not imagine that any single symptom is ever sufficient for the diagnosis of a disorder which at its commencement is necessarily complex. Nothing but the grouping together of a number of signs, with the indirect evidence afforded by exclusion, will afford the basis of a positive diagnosis.

In abnormal cases tolerably developed, however, there is no difficulty in arriving at a positive diagnosis. The general signs of the disease become more developed, and on examining the chest we will always find dullness at the summit of one or both lungs, and various alterations of the voice and respiration at the same place; such as bronchial or cavernous respiration, crackling, and finally, resonance of the voice.

Prognosis. The prognosis of phthisis is unfortunately quite

clear in the large majority of cases; and when the disease is once fully established it is regarded as almost necessarily fatal, or at least that although its course may be much retarded, it is not capable of cure by any remedial means at the ordinary disposal of the physician. This prognosis must, however, be taken with some reservation, as the disease is in its nature essentially different in different stages, and cannot be said to be unavoidably fatal except when the disorganization of the lungs is much advanced, and the tuberculous degeneration of the whole economy is carried to a very high degree. In the earlier stages the disorder may terminate in recovery; and there is no doubt that it not unfrequently gets well, even when the local sign of the disorder, resulting from the deposit of tubercles themselves, is actually formed. But these are not the most common cases; for before any actual deposit of tubercle can take place, a very extensive alteration of the whole fluids has in all probability occurred, and the deterioration will be found to have reached that point which renders recovery rare, but not impracticable.

Although in many cases of phthisis the possibility of recovery is now generally admitted, this result is by no means probable except when a number of favorable circumstances concur; for as the causes of phthisis are for the most part very slow, but at the same time very powerful in their action, the disease cannot in many instances be materially influenced by remedies. It is therefore unfortunately true that even when we foresee that the disease is approaching, or distinguish the first steps of the tuberculous formation, it cannot always be arrested; but there are other cases in which the result is happily much more favorable.

In order to distinguish these cases, we must bear in mind the circumstances already mentioned as complicating the progress of phthisis or influencing its development. Of these the most important are a strong predisposition to tuberculous consumption, whether hereditary or acquired, and an exposure to circumstances known to favor the development of the disease. Individuals who present this constitutional tendency are those who offer the well-known signs of the scrofulous constitution denoted by the peculiar color of the skin, and have generally the very dark or the light rosy complexion; when the disease is hereditary, the dark com-

plexion is perhaps more frequent than the light, and the skin has then a dusky, earthy tint, or a dirty aspect, which is often almost peculiar to this disease. It is not always the case that those persons are thin and feeble—some of them are stout and muscular—but feebleness of body increases the tendency to the tuberculous development; and we may make the same remark with still greater force of the fat, pale, tallow-like complexion of some individuals, especially women, who possess a hereditary tendency to phthisis; the latter class of patients generally offer an enlarged, fatty state of the liver, and the prognosis in this case becomes very unfavorable.

If exposure to the causes favoring tuberculous development cannot be prevented, the influence of them must be obvious enough, and will greatly increase the probability of an unfavorable issue. In all cases, therefore, in which any direct evidence of tuberculous deposit is conjoined with hereditary tendency, or other strongly disposing causes, the disease is most intractable; this accounts in a great measure for the more frequently fatal termination of phthisis in the crowded and impure wards of a hospital. If there be no local signs whatever, but merely that constitutional deterioration which, unless arrested, is sure to end in phthisis, our prognosis is different; these indeed are scarcely to be considered as true cases of consumption; they are so only in embryo, and may be often arrested by change of residence, or other means.

The mode of development, and the early symptoms of phthisis, have also a considerable influence upon its termination. Some cases are unfavorable from the beginning, not merely from the strongly-marked general symptoms, but because the local signs are known by experience to coincide with intractable forms of the disorder. The symptoms which may be regarded as impressing a favorable character upon the disease are hæmoptysis, if occurring from time to time after exertion, and very moderate and local inflammation of the lungs before tuberculous matter is deposited in any large quantity.

Hæmoptysis, if extremely abundant, is not favorable, unless the patient should get perfectly well without irritative fever or further symptoms of tubercles; it then seems to relieve the lungs,

and the disease is in general milder, and not unfrequently abates at an early period. But there is another form of hæmoptysis which often occurs long before the disease seems to be concentrated upon the lungs, and is perhaps rather referable to a peculiar condition of the whole capillary system than to any local mischief: this renders the prognosis much less favorable; it is the spitting of blood, which often continues for years, a mouthful or two at a time after coughing or very slight efforts, and is hardly noticed by the patient. It is most frequent in young women, and in those who offer a strong constitutional tendency to phthisis.

The local inflammation of the serous membranes, or of the serous tissue of the lungs, is a favorable sign, because the action which gives rise to the disease is here a positive, tangible one; and if we succeed in changing it, or modifying its progress before tubercles are formed, the disorder may be arrested much more easily than in the more constitutional cases. If the tuberculous matter be actually formed, but limited to small portions of the lung, the prognosis may still remain favorable to a certain extent—that is, the disease will be slow, and in a few cases will terminate happily, notwithstanding a cavity is formed.

The least favorable local signs are those observed when the disease begins in a slow insidious manner, by the trachea or larynx, which does not always call attention to the lungs, and the tuberculous degeneration proceeds in an unsuspected form. Not that chronic laryngitis is of itself necessarily fatal, but it certainly promotes the formation of tubercles; and when this point is once reached, the disease generally assumes a severe and unmanageable character. In these cases, too, the tubercles are often scattered wildly through the lungs, and of course are productive of more mischief than if they are limited to a small space at the summit.

The prognosis of phthisis must be taken in a more extended sense than that of its ultimate termination: we have to decide in many cases whether the disease is to terminate speedily or slowly, in death or recovery; this investigation leads us to the study of the varieties of phthisis in relation to its character. Another circumstance which has a powerful effect in modifying the prognosis of tuberculous consumption is the treatment of the disease.

Thus, after cod-liver oil was generally introduced, a very considerable delay in the fatal termination of the disease evidently occurred. This slow course deceived many physicians, who fancied that patients were recovering when they merely improved by regaining flesh and losing their irritative fever, although the disease afterwards increased. Careful treatment, however, has, no doubt, a decided influence in modifying the prognosis.

The hopeful turn of mind in some patients is another very powerful retarder of fatal consumption, and occasionally leads to an entire cure. If, on the other hand, the patient should be of a desponding, melancholic temperament, the prognosis is much more unfavorable, not only as regards the ultimate termination of the disease, but also with reference to a much more early death.

All these various circumstances must be carefully weighed by the physician before making up his prognosis. He must, however, remember that it is his duty not to announce to the patient that he will certainly die. A careful and conscientious physician, while he avoids promising a cure, is always very unwilling to destroy the patient's hope; for without a reasonable expectation of improvement, he is apt to hasten his own death from the entire dejection of mind.

The prognosis of phthisis is to considerable extent modified by the age of the patient. It is a much less grave affection in the old than the young, sometimes scarcely shortening the average duration of life in those who have passed the age of fifty.

Duration of phthisis. Although consumption of the lungs is, in the large majority of cases, a chronic disease, it is from time to time met with in an acute form—that is, it may prove fatal in a period of less than three months. This depends upon the rapid formation of gray granulations, or tuberculous infiltration in a large portion of the lungs. The disease is then attended with much fever, and the general tuberculous signs, as already mentioned, are extremely developed. In many instances death does not take place so much from the pulmonary disorder as from the coincident inflammations, or tuberculous deposition in other organs, especially in the serous membranes of the brain. But phthisis may become acute when it begins in the ordinary chronic form, and the change is then rendered apparent by the rapid increase

and severe character of the fever and sweats. Hence, although we know that the usual course of ordinary phthisis is slow, it is always possible that the type may change, and the termination may be much more rapid than usual.

Our opinion as to the termination of phthisis in acute cases is directly dependent upon the diagnosis; for if we once recognize the disease as of the acute form, we can confidently state that its course will be prohably a short and fatal one. The duration of the ordinary variety of phthisis has been estimated by Dr. Louis to be about eighteen months; this is, perhaps, sufficiently near the truth, but a large proportion of cases in hospital practice terminate in less than that period; in private practice the course of the disease is delayed so much by treatment, that the average duration of all cases, except the acute, is probably two years—perhaps three years or more, since the use of cod-liver oil has become general. The duration of consumption is greatly influenced by age; the disease is often acute in the young—rarely so in those more advanced in life; in the latter class of patients the consumption is much more slow than it is in a young subject. The female sex has a similar influence with childhood, so that the most frequent cases of acute phthisis are to be met with in young girls, a little after the age of puberty.

The more chronic varieties of phthisis are sometimes very remarkable. There are, indeed, not a few cases in which, although the patient may at last even die of consumption, his life may be protracted almost to the ordinary period; thus instances in which the disease lasts twenty or thirty years are not at all uncommon.

Sometimes, indeed, patients continue to be affected with phthisis for a still longer period, and at last succumb to it.

Chronic phthisis, however, is not permanently attended with fever; there is usually increased frequency of the pulse when the tubercles are in process of formation, or softening. But when these stages are past, the patient may regain, to a considerable degree, the appearance of good health, and even increase decidedly in flesh. In other cases the patient remains feeble and emaciated, still complains of indisposition, and has a slight cough; but all the more acute symptoms cease. These cases of chronic phthisis are frequently thus protracted; partly from the moral condition

of the individual, which induces him to resist the attacks of disease, and partly from his leading a life decidedly antagonistic to it.

Treatment. The treatment of phthisis is by many regarded as never curative, but merely as a means of palliating the most severe or harassing symptoms of the disorder. If we apply the term consumption only to those cases in which the disease is far advanced, and the constitutional deterioration is extreme, it is very plain that no means of cure exist, and that even palliation is in many cases difficult; but if we speak of consumption as of other diseases which tend to a fatal termination only after having passed through their early and more curable stages, it is strictly capable of cure, and, like these disorders, must be treated in different ways, according to the mode of its development.

As tubercles are attended with very different symptoms, and originate in various modes, it is very clear that the most opposite methods of treatment may prove efficacious in combating the affection in its forming stage. But after the tuberculous deposit has fairly commenced, it obeys its own laws of growth, and presents the secondary symptoms, such as hectic fever, emaciation, etc., which are peculiar to itself, and then one uniform method of treatment is desirable, or at least seems indicated. Besides, although the modes of development of tuberculous diseases are very numerous, there is a form in which the symptoms are regular and uniform; and even in those varieties in which the modes of origin are most unlike, there is a peculiar character impressed upon the various symptoms, which is dependent upon the scrofulous or tuberculous diathesis.

This treatment would be specific for the disease, and might be curative if it could cause with certainty the absorption of the secreted product, and favor the cicatrization of cavities, when the loss of substance was not extremely great. If we possess such a mode of treatment, we might then with great confidence expect to cure phthisis in nearly every stage. But as no real specific exists, we are obliged to content ourselves with the administration of alteratives, which have but a limited influence on the growth of tubercles, and of such remedies as act either upon the causes of the disease, or on the accidental disorders which favor the tuberculous deposit in an indirect way.

The alteratives used in phthisis are, for the most part, such as exercise a tonic and invigorating influence, at the same time that they produce their proper effect as alteratives. Mercury is always injurious as a direct remedy in phthisis; it can never be of service except in those cases in which there is decided inflammation, and the tubercles result directly from it; but even in this class of cases the influence of the remedy is certainly injurious so far as it exerts an effect upon the proper tuberculous disorder, and it must be discontinued as soon as the inflammatory symptoms are removed. The effect of mercury in phthisis is now so well known that it has almost become an axiom to avoid it in the treatment of this disease.

Iodine was until lately more used than any other alterative; and if employed with discretion it scarcely ever does harm. I have found it sometimes beneficial at the commencement of cases in which the fever was but moderate, and the local inflammation but slight, especially when a circumscribed chronic bronchitis has preceded for a long time the actual development of tubercles. Hence it is well suited to those cases which are preceded by chronic inflammation of the trachea and larger tubes, and pass slowly into phthisis; and especially to those cases which are most closely connected with external scrofula. The patient is then often robust in appearance, and the local disease is slow in forming. Iodine is also useful in the purely constitutional cases, provided it be given cautiously, and the emaciation of the patient has not advanced very far; it should then be combined with vegetable tonics.

The preparation to which, from habit, I was at one time accustomed to resort is Lugol's solution, prepared of the strength directed in the United States Pharmacopœia—that is, one scruple of iodine and two of hydriodate of potassa to seven drachms of water. Of this I gave to an adult from three to six drops two or three times daily; I seldom exceeded six drops three times a day, and often gave much less. For the good effects of the medicine may be obtained much more certainly in this way than by giving it in larger but more irritating doses. I now scarcely ever give this preparation, as the simple hydriodate of potassa is milder and at least equally active.

I have never witnessed any other mischievous effects from the iodine than the disorder of the digestive canal, and a fullness of the head which sometimes results from it; but it is very certain that in some rare cases it acts as other powerful alteratives occasionally do, and it may enfeeble or disturb the functions of the whole body, without removing the morbid action. Hence it is advisable to discontinue its use from time to time, and resort to mild purgatives for a few days, or to abstain totally from all medicine until the tone of the stomach is restored; it then is scarcely possible that an injurious result should follow.

As the action of iodine is slow, we cannot observe any immediate impression produced by it; but when it is acting well, the complexion and strength of the patient improve, and the cough at the same time gradually diminishes. The latter effects may be promoted by appropriate expectorants, which should be given at the same time with the iodine. The appetite and strength almost always increase; and if these fail, or become less instead of increasing, it is almost a sure indication that the medicine is not acting well. It is often useful to administer laxatives from time to time, even if the medicine be not suspended. As iodine evidently acts merely as an alterative, it is beneficial in that condition of the economy which precedes the secretion of tubercles, as well as in their more advanced stages; and it may be conjoined with other alteratives, or with mild tonics. Without attributing to iodine any specific virtue, I am quite convinced that its powers are of some value in commencing phthisis, and that it sometimes checks the progress of the disorder. The remedy seems to me to be not at all adapted to those cases in which tuberculization is very rapid, or the inflammation of the serous membranes very acute—that is, precisely to the worst cases of the disease.

The hydriodate of potassa is on the whole preferable to the solution of iodine—that is, it acts with less irritation to the alimentary canal, and may be given with safety in many cases of the disease. The dose is from three to five grains three times a day: the remedy should not, however, be continued long without intermission; it should be discontinued, and after a week may be resumed. There are some patients who cannot take iodine in any form without great irritation; and at Geneva, in Switzerland, it

was stated to me by several medical gentlemen of very high authority, that the remedy cannot be given except in very small doses—that is, doses of five grains produced very violent symptoms. This remedy is very far from producing at other places similarly injurious effects: as a rule it would seem that, from some unknown circumstances, it in that situation loses its remedial power and acquires most mischievous properties. For some years past I have very much restricted the number of cases in which iodine seems to do good. I still use it occasionally but much less frequently than was the case before the introduction of cod-liver oil.

A few years ago a new remedy was introduced to the profession in the treatment of pulmonary consumption, and its use has astonishingly increased. It is the cod-liver oil. This oil, which is obtained from the liver of the codfish, is brought to market in three principal varieties: the best and most tasteless is nearly or perfectly transparent, with but a slight odor or taste, and is almost always taken by patients, without difficulty; this is said to be obtained from the liver of the cod very soon after the fish is taken, and before the least alteration has taken place in the oil. Another variety is of a dark-reddish tint, of more decided taste and smell, and is obtained from the liver of the cod a day or two after it is caught; the color and taste are probably owing to a slight decomposition which has taken place in the liver before the oil is extracted. This variety is by no means so easily borne by the stomach as the paler kind; indeed, I have found that many patients could not take it without manifest suffering, who tolerated the first-mentioned variety without the slightest difficulty, but were nauseated and oppressed as soon as they attempted to take the highly colored oil. The third variety is of a still darker hue, and is probably obtained only from the liver of the fish after decomposition has fairly commenced; this oil is not used at Philadelphia except by tanners in dressing hides.

The chemical composition of the cod-liver oil is known. It contains, besides the usual constituents of oily matter, a small proportion of iodine—too small, however, to induce us to suppose that any portion of its powers depend upon it. Unfortunately, chemists are not able to suggest any positive test for its purity;

and there is great reason to believe that the quantity of the oil in the market will not diminish, notwithstanding the number of cod caught may not increase; and its comparatively high price offers a strong temptation to many unprincipled venders. Still, there is reason to believe that the greater part of that now offered for sale is pure—at least all that comes from sources of undoubted reputation. Other animal oils have not been tried sufficiently to ascertain whether they are similar in their effects to that of the cod-liver. It is said, however, that they are not so; but I must confess that it seems to me very probable that they will not be found to differ very materially. From the trials which I have made of them, in many cases, I believe that other animal oils are nearly as efficacious a remedy as the cod-liver oil.

The dose of the cod-liver oil is a tablespoonful three times a day, taken in a little of the froth of beer or porter; any other liquid not possessing any positively medicinal properties may, however, be used in place of the froth of malt liquors. A very good, and perhaps a better mode of taking the oil, is to chew a small piece of orange-peel, then to swallow the oil either pure or floating in some aromatic infusion or a little rose or orange-flower water, and afterwards again to chew a fragment of the orange-peel. In this way there is no disagreeable taste perceived. Another very good vehicle is a little brandy; this should be used for rinsing the mouth upon taking the oil, and a very small portion may be given with it.

Many patients are not able to take the oil as often as three times a day without repugnance; it may, however, often be given to them twice a day without difficulty. In these cases it should be given about two hours after dinner, and again in the evening. When the patient takes the usual dose three times a day, I have been accustomed to allow him to take it at such times as are least disagreeable. It is often, indeed generally, best to begin with a less dose than a tablespoonful; a dessertspoonful or even a teaspoonful twice a day is often enough at first; but as soon as the patient becomes a little accustomed to the remedy it should be increased to the usual dose. It is very rarely, if ever, necessary to give the oil in larger doses than a tablespoonful; some patients, however, prefer taking a larger quantity. In those cases I should

not object to the dose being a little increased; but if the oil be given in very large doses it is apt to produce purging, and of course cannot be absorbed in sufficient quantities to produce its peculiar effects of increasing the amount of fatty substance of the body.

Some consumptive patients are not able to take cod-liver oil, as it produces much nausea and an insufferable disgust, which prevent the patients from taking it at all. At other times they can bear it with great difficulty, especially if the dark-colored oils be used: in these cases they may sometimes still take about two dessertspoonfuls a day, but they cannot use the oil in sufficient quantity to offer a reasonable hope of decided improvement. The disgust which patients not unfrequently feel toward the oil will, however, not always continue; by attending to the time at which it is taken, and occasionally changing the vehicle in which it is administered, they sometimes acquire a power of retaining the medicine which at first would scarcely be expected. When I prescribe it, therefore, I am always very unwilling to believe that a decided disgust can prevent its exhibition, and I only give it up when I become convinced that the stomach of the patient can no longer tolerate it. Diarrhœa, when the intestines are much ulcerated, sometimes prevents the persistence in the use of cod-liver oil. As a general rule, unless I can check the diarrhœa by the addition of a few drops of laudanum, I regard this symptom as contra-indicating the oil whenever it is increased by it. In the majority of cases of phthisis, however, diarrhœa is not a constant symptom until the very last stage of the disease, when cod-liver oil or any other medicine can do but little good.

When cod-liver oil does good the patient increases in flesh, and loses, to a certain degree, the characteristic physiognomy of phthisis. The pain and cough also diminish—sometimes are scarcely to be perceived at all—while the physical signs of the disease are also sometimes lessened, although generally not in proportion to the decline in the general symptoms. But in one patient who entered the Pennsylvania Hospital a few years since under my charge there were decided crackling, imperfect cavernous respiration, and flat percussion at the summit of one of the lungs, together with fever, cough, and emaciation. He was put

under the use of the oil; at first the only kind tried was the dark colored; this, however, produced much nausea and could not be taken regularly; the transparent oil was afterwards given: the remedy was continued by Dr. Wood during his term of duty. In March, 1850, about six months after the patient had commenced the treatment, he had become much fatter, so as to present the aspect of a person in at least the average condition of health; the pain had subsided; the cough was nearly gone; and the physical signs much improved. That is, there remained only a very faint blowing sound of the respiration at the summit of the lungs, with a little dullness of percussion. Like all patients who have used the oil for a long time, his whole skin had assumed a dirty, greasy hue, showing the entire absorption of the oil, and its transmission to the exterior of the body, much in the same way as sulphur taken internally seems to permeate the whole tissues. This case was the only one of those treated during my term of service, or that of Dr. Wood, in which the amelioration was so decided as to merit the title of cure. In a number of patients we found that there was a decided improvement; sometimes they gained flesh decidedly, and the cough much diminished. These marks of improvement although real, are not, however, permanent; the cough and fever commenced again and the patient rapidly emaciated, while the remedy was not borne perhaps as well as it had been at an earlier period. In a majority of cases in which the patients were evidently affected with pulmonary phthisis, benefit certainly does result from the cod-liver oil; but in how large a proportion there is a decided and real improvement in the symptoms, cannot now be pointed out with certainty. In a few cases we may expect a cure.

I am, however, by no means sure that the cod-liver oil is destined to be looked upon as the remedy adapted to most or nearly all the cases of pulmonary phthisis. It will certainly be regarded as a valuable remedy, and one that cannot easily be exchanged for any other, until some one possessed of better, or at least as good qualities, can be discovered. Like all new remedies, it has undoubtedly received as full a share of attention as its certain results have yet warranted; and perhaps after physicians discover that it is not, in the large majority of cases, an

actual cure of phthisis, they may be tempted to throw it aside without giving to it the value which it really deserves. Patients themselves are now almost always willing to aid the physician in an attempt to stay the progress of so fearful a disease, and we have, therefore, rarely any difficulty in giving it to those whose stomachs are not too irritable to support it; and in many cases they are anxious to resort to the remedy as a last resource, when hope cannot longer be entertained of even a partial improvement.

It is very certain that the cod-liver oil will be found to be most serviceable in cases in which there is a strong hereditary tendency to consumption, although the disease is not yet fairly developed. In these cases there is often much emaciation for a long time before cough or fever appears. The patients generally have a good, sometimes almost a voracious appetite, but still they do not at all gain flesh; on the contrary, they remain excessively thin. In these cases, it has seemed to me the cod-liver oil may be taken in small doses for a long time, to develop a greater degree of embonpoint, and remove the extreme leanness which is often a sign of commencing phthisis. Such patients may take the oil in doses of a dessertspoonful twice a day for many months.

In other cases the disease begins slowly, the patient loses flesh, coughs, and there is a slight alteration of the sonorousness and of the respiration at the summit of one of the lungs. In these cases, too, we may expect decided advantages from the oil, which should then be given in the usual dose, and all proper directions as to air and exercise should be conjoined with its use. We may in these cases, I believe, sometimes succeed in eradicating the tuberculous disease; a result which is scarcely to be looked for when there are cavities and a larger deposition of tubercles in the lungs.

But there is a question which is a very important one: Does cod-liver oil ever cure pulmonary consumption when it is decidedly advanced, and cavities exist in the lungs? For my part, I must confess that I have never yet met with a case in which the physical signs, as well as the general symptoms, have entirely disappeared. Indeed, in most cases of the disease we do not find that the physical signs diminish as decidedly as the general symptoms.

Sometimes the cavernous respiration and the flat percussion actually increase while the patient is gaining flesh, and his fever is considerably lessened. In these cases, however, the tuberculous deposition goes on, but the patient becomes less sensible to its effects in the general system, and therefore no longer emaciates, or even actually gains flesh, while the tuberculous formation continues. We are therefore obliged to conclude that cod-liver oil is not properly a specific against phthisis, and does not usually prevent the tuberculous deposit; it simply increases flesh notwithstanding the disease; and sometimes indirectly brings about a permanent cure in cases in which the tuberculous tendency has been ameliorated, and is therefore readily removed. The ordinary articles of food, it has been long known, should be nutritious in cases of commencing phthisis, and if we add to food which often cannot be readily taken, or at least digested by the patient, a substance which has the power of promoting the fatty development, and thus antagonizing the prominent symptoms of the disease, we do a great deal, and leave the patient in the best possible condition for recovery.

My own impression, however, is, that cod-liver oil is certainly most useful in those cases in which patients are evidently disposed to consumption, and have inherited a strong tendency to it, although it is not yet developed. I would recommend the use of the remedy in these cases, especially when the patient is already thin or slightly emaciated, and I direct it to be taken as an article of food rather than of medicine for a long time. When the patient is either positively averse to the remedy, or becomes tired of it, he might try other animal fats or vegetable oils, in the hope of producing similar benefit. For, as I have already intimated, I am convinced that the cod-liver oil is better than other animal fats, simply because it is more easily digested and thus absorbed into the system. We therefore see that it is a matter of no little importance to procure oil which is free from disagreeable smell or taste. At first when I prescribed the oil there was none of the pale colored in the hospital, as it happened at that time to be exceedingly scarce in Philadelphia. But few patients would take the darker oil without suffering more or less uneasiness at the stomach, which often prevented its continual use: the

light-colored oil was almost always perfectly well tolerated, and sometimes patients seemed almost to acquire a fondness for it.

The following statement is one for which I am indebted to Dr. Levick, at that time one of the resident physicians of the Pennsylvania Hospital. It gives the results obtained in that institution for the space of six months, in which the medical wards were under the care of Drs. Wood, Pepper, and myself, attending physicians to the hospital.

The following may be given as the results of the use of cod-liver oil in the medical wards of Pennsylvania Hospital during the last six months, (1849–50.)

1st. *Of the oil.* That the light-colored oil can be taken without difficulty by patients whose stomachs have steadily rejected the brown oil.

2d. *Of the mode of administration.* That a few of the patients have taken the oil without any adjunct to disguise its taste. That its nauseating properties are corrected by its administration with milk; but that its taste is most effectually disguised by the froth of porter.

3d. *Of the time of its administration.* As a general rule it has been taken before meals, but in four instances where it was not tolerated before meals it was readily taken after meals.

4th. *Of diarrhœa as a contra-indication to its use.* The existence of diarrhœa is not a positive contra-indication to its use. In three instances in which patients were thus affected, no increase of the symptoms was produced by its use, and no diminution by its abandonment. In a fourth instance when the diarrhœa had previously existed, the discharge appeared to be increased by the exhibition of the oil, and abated with its withdrawal.

5th. *Of its effects in cases of phthisis pulmonalis.* Patients using the oil have increased in flesh, in weight, and strength. While using the oil, their cough and expectoration have diminished; that with some, hectic and rigors have entirely disappeared. Six of them have been so much benefited as to leave the hospital and resume their former occupations. In one instance, a patient who entered the hospital with cough, copious purulent expectoration, extreme emaciation, inability to leave his bed, and with the physical signs of a cavity under the left clavicle, after

six months use of the oil left the hospital weighing 140 pounds, with little or no cough, no hectic or rigors, and with an almost entire absence of expectoration, the physical signs having greatly diminished.

6th. *Of the physical signs.* The improvement of the physical signs is not coincident with that of the general symptoms.

7th. *Of its use in general scrofula.* In scrofulous diseases where there was no reason to suspect the existence of pulmonary tubercles, the improvement of the patient's health has been very decided.

8th. *Of congestion of lungs as produced by cod liver oil.* There has been no decided evidence of such a result following the use of the oil in the preceding cases. [Two patients of the twenty, while using the oil, had severe attacks of hæmoptysis, but there was no reason to refer them to the use of the remedy.]

9th. In those cases which have terminated fatally, the appetite, the nutrition, and strength of the patient appeared for a time to be decidedly increased; the life of the patient seemed to be in this manner temporarily protracted; but for a few weeks immediately preceding death the remedy seemed to have entirely lost its value.

10th. *Length of time, etc.* To be of any decided permanent benefit, its use must be steadily persisted in. It should be continued even after the most striking symptoms of the disease have in a great measure disappeared.

Within the last ten years, since these earlier observations upon cod-liver oil were made, my experience in its use has been very large, and enables me to speak positively on many points which were formerly somewhat doubtful.

First. Is cod-liver oil as good a remedy in the management of phthisis as it was thought to be? My own settled conviction is, that the oil is one of the best nutrients that can be given; in that way it antagonizes phthisis to a certain degree, and sometimes puts a radical check on the disorder; but I do not believe that its properties depend upon any specific virtue. It is simply introducing into the system a large quantity of fatty matter, thus directly opposing the formation of tubercles. Indeed, I have sometimes thought that in those rare cases of phthisis in which

there is little or no emaciation, cod-liver oil does not act so kindly as in those patients who assume the peculiarly thin and emaciated aspect of regular consumptives.

Secondly. Cod-liver oil is not tolerated well during the hot months, in our climate. Patients are often obliged to abandon its use, or at any rate to restrict the quantity, during the summer; they may often resume it again when the weather becomes cool, and the powers of digestion are increased. The difficulty of taking it during the hot months depends entirely upon the extreme nausea which it then causes; if the patient does digest it well, he may cautiously continue it even in intense heat, but he should at once abandon it if his power to digest it becomes enfeebled.

Thirdly. The remarks already made as to the use of the darker-colored oils have also been thoroughly confirmed. In Philadelphia, as in most other parts of the United States, there is now scarcely any other oil than the light colored given—that is, either the livers of the fish are prepared very soon after they are obtained, or else the oil must be so purified as to destroy the offensive taste and aspect of the dark-colored variety.

Fourthly. Patients can frequently continue the use of the oil for a long period; but after their stomachs have become thoroughly disgusted with the medicine, it will be found almost impossible for them to return to it. It is true that a temporary cessation of this remedy may cause the stomachs of the patients to be so much relieved that they can resume its use, but this resumption is but temporary. They are rarely able to return to it again as a permanent plan of treatment, after they have once been completely disgusted with it. Hence I rarely attempt to persist in its administration when unequivocal evidence of disgust on the part of the patient is exhibited.

Fifthly. The employment of cod-liver oil has to a certain degree diminished. Physicians who resorted to it under the conviction that it was a sure remedy for phthisis have been disappointed in the results obtained from it. Many of them therefore have very much abandoned this medicine; the error with them however is, that they have expected too much from it, and finding themselves to a certain degree deceived, they have neglected a

valuable remedy. The worth of it remains, although this was exaggerated by the overweening expectations of its early advocates.

Other fatty matters answer very nearly the same end as cod-liver oil. Thus the fat of a freshly-boiled ham, which flows from it when cut, sometimes acts admirably well as an anti-tuberculous remedy. I was first led to administer this article by the recommendation of a physician now deceased, Dr. Hays, of Carlisle, Pennsylvania. More than thirty years ago, I remember to have heard him recommend the fat of ham as a very good remedy in phthisis. I was myself in the habit of using it before the introduction of cod-liver oil. It often acts well, when it is tolerated by the stomach; but many become disgusted with it, and I believe are more easily led to refuse it than the oil.

Cream is also often a valuable remedy. If the cream is pure and rich, it should be taken diluted with milk—that is, half a tumbler of each may be given once or twice a day; at breakfast it may always be taken, and sometimes either after dinner or in the evening. The cream obtained in large cities may almost always be used pure, being sufficiently diluted with milk before it is brought to the consumer. This remedy produces very nearly the same effect as cod-liver oil; increasing the deposition of fat, and in that way antagonizes phthisis.

Any other oily substance may be likewise used as a remedy. The fat of beef, mutton or any other meat, if the stomach will tolerate it, may be directed for tubercular patients; thus confirming very closely the rule already laid down, that cod-liver oil is better than other animal oils, simply because it is more readily absorbed. Were it equally susceptible of digestion, I believe that ordinary whale oil would be just as potent a remedy; but it is in the more ready absorption of cod-liver oil that its value as a remedy in phthisis consists.

My impression is that within the last few years the number of cases of phthisis has increased; and I have been tempted to ascribe this increase as much to the prolongation of the cases treated by cod-liver oil as to anything else. There has been perhaps an accumulation of old and protracted cases which have terminated at nearly the same time as those more recent. Whether

this is really the case or not, I would not pretend to assert; but I believe, at any rate, that the duration of cases of phthisis is lengthened by the use of cod-liver oil.

Another mode of treating phthisis which has attracted much notice within the last few years is the use of different phosphatic salts, given in connection with one another. These are the phosphates of iron, soda, lime, and potash. This plan was proposed by Dr. Churchill, and was founded on the supposition that the addition of these salts to the blood would enable it to withstand the tendency to tuberculous deposit. I have been chiefly in the habit of giving these salts simply mixed with water, directing the patient to shake it up before taking it, so as to suspend the phosphate of iron, which is of course insoluble. The mixture is made according to the following formula:—

℞.—Sodæ phosphat, ʒiv; Calcis phosphat, ʒij; Potassæ phosphat, ʒi; Ferri phosphat, ℈ij; Aq. Rosæ, ℥vi.—M.

S. A teaspoonful after breakfast and dinner, first shaking the bottle. If the substance is well shaken, the phosphate of iron may be of course sufficiently suspended to be taken in a proper dose.

Mucilage should not be added, as it would soon spoil. My friend Dr. Jackson has been in the habit of giving the same medicine in sirup, making a more uniform and prettier preparation, but one which I do not like so well as a simple suspension of these salts. If, however, this preparation should be preferred, the best mode of making it is one given by Mr. Parrish in the Am. Journ. of Pharmacy for 1857, vol. xxix. p. 572.

The use of these phosphates became very general in Philadelphia, but has much diminished within the past year or two. This comparative disuse of them has arisen simply from the doubt that remained in the minds of those who employed them as to their utility. The iron produces, of course, its usual effect; but whether the phosphoric acid is really taken into the blood, and deposited in quantities sufficient to cause the absorption of tubercles, or their conversion into calcareous matter, seems to me very doubtful. It has been also supposed that by absorption the phosphorus is diffused throughout the whole body, and to a certain degree antagonizes the process of emaciation. I

have never been able to convince myself with certainty that this good result had occurred; and although I still occasionally use the preparation, I do so with a doubt whether any good effects follow from it.

It is, however, true that it does not at least often do mischief; and unless it should disturb digestion, or annoy the patient by the administration of medicines of doubtful value, it may be tried in many cases of phthisis. It is more particularly suitable in the chronic cases of the disease, when from the natural course of it we are sure that the digestion of the patient will not be interfered with, and where all the good results attributed to it are best secured. It should be taken from fifteen minutes to half an hour after each meal; if the sirup is used, a teaspoonful of it may be given at those times. It is then intimately combined with the food, and is readily absorbed into the blood.

In advanced cases of phthisis, hectic supervenes; and all alteratives are useless, unless they act merely as tonics. Indeed, cod-liver oil has often appeared to me to be of positive injury after softening had taken place. That is, especially in those cases in which the hectic fever is intense and the power of digesting the oil is diminished.

In the early stages of tuberculous disease of the lungs, hygienic alteratives have always claimed the first place; indeed, it may readily be believed that no medicinal alterative can well be useful if the hygienic measures which are best adapted for the disease be neglected. These are very well understood; and, besides, the choice of proper localities for a residence, and for a journey or sea voyage, consist mainly in adopting such precautions, and in pursuing such a course of life, as are least fitted to develop the disease.

The alterative effects of a long journey and a change of residence are well known in phthisis. They both act nearly in the same way: a journey in the pleasant season of the year, or in a climate which renders all seasons agreeable, is often of great benefit in forming phthisis, or in those varieties of the disease in which there is not much febrile excitement or local inflammation; if these exist, the exercise is irritating instead of invigorating. If the strength of the patient be good, the journey should be

made on horseback, or in an open carriage, and be pursued as long as the strength of the patient continues to improve. A sea voyage is sometimes preferred to a land journey; but, as a general rule, it is less useful. There are, however, cases in which the strength of the patient is not great, but the disease at the same time is slightly advanced, and the fever moderate, in which a sea voyage in a mild latitude is of great benefit. It is also of service in those cases in which the phthisis is attended with slight but frequent hæmoptysis during its early stages. A short voyage is of little comparative benefit; it should be long enough to act as a decided alterative; hence one to the East Indies, or to the Mediterranean or South America, answers best. The shorter voyages to Madeira or the West Indies are only advisable because they are necessary to a winter's residence in these climates.

The question of a change of residence is always of great interest to a phthisical patient; in fact, there is no one upon which he is more disposed to consult his medical adviser. The general anxiety felt by patients to resort to this mode of relief is a conclusive proof that there is something in it, for it still continues although the lapse of years shows that the advantages of such a residence are much overrated. These advantages may be stated very briefly. By a winter's residence in a warm but equable climate, the tendency to slight congestions or inflammations of various portions of the organs of respiration is obviated, and a cause of irritation is then removed. Secondly, the mildness of the climate allows the invalid to enjoy the advantages of fresh air and exercise without much discomfort or risk. Lastly, the change of climate and of air is of itself of great benefit as an alterative. These advantages are, however, limited; they are not specific in the treatment of consumption; hence many cases are not at all relieved—some are even aggravated.

If the disease be of the acute form, and especially if it be attended with much fever, the patient is almost always rendered more uncomfortable by the journey, and the affection tends to advance more rapidly; or if the disorder be so much advanced that the strength of the patient is rapidly declining, no advantage can be expected. It is in the milder and more chronic cases that

the change of air does good, especially if the patient has found by experience that the winter is of injury to the organs of respiration, and gives rise to much cough or other signs of laryngeal or tracheal irritation. Of this class of patients, very few individuals will be found to die abroad; most of them return with some relief of their symptoms, especially for the first winter; if the disease be not arrested, however, the benefit of a second winter is very doubtful. When the disorder of the digestive organs is a prominent symptom, the benefit from the voyage is very considerable, but the effects of a protracted residence in a warm climate are very doubtful.

The advantages resulting from a change of climate are not, therefore, such as to induce us to advise patients to leave their homes, and subject themselves to many privations without due consideration; and we should steadily oppose it, if the reasons for the voyage are not strong.

Women are very rarely benefited by change of climate. The effort of leaving home and the loss of the society of their friends, with the many other discomforts to which they are subjected, tell upon them very much; in fact, they form, in the main, strong reasons against an attempt to change the climate in which they may be living. Even in the case of males, the subject is one which requires mature reflection; multitudes of patients are every winter sent to the South, and to the West Indies, simply because their physician feels that their continued presence is a reproach to him, on account of his inability to cure their disease.

Considerations of this kind, however, are not such as ought to influence an honest medical practitioner. He ought in the first place to reflect whether the patient would be benefited by exchanging the comforts of home for the many necessary inconveniences encountered in a new residence. If he is convinced that good would result from such a change, let him direct it; but let him always conscientiously weigh the circumstances of each individual case, before giving an opinion which sometimes amounts to banishment.

Patients are usually sent to spend the winter in a mild or warm climate: but in some Southern localities, where the climate is damp, phthisis becomes exceedingly fatal. Thus an eminent physician of New Orleans recently informed me that multitudes of

tubercular patients were sent there every winter, only to die more rapidly than they would have done at home. Of the localities at all adapted for a winter residence for tubercular patients, in the United States, Florida, on the St. John's River, or Aiken, in South Carolina, afford the mildest climates in most years. Both these places, however, have the disadvantage of the accumulation of a large number of consumptive patients; so that the constant sight of suffering objects is in a certain degree an objection to them. Some localities, however, have been fitted up with peculiar appliances for the comfort of persons laboring under phthisis.

Within a few years past, attention has been called to another climate, very different from that of the mild or even tropical localities to which phthisical patients were at one time exclusively sent. We allude of course to the northwest part of the United States. It is said that the continued but almost equable winters of those regions enable patients affected with phthisis to improve and sometimes apparently to get well. Thus the neighborhood of the Copper-mines, on Lake Superior, and different localities in Iowa and Wisconsin, have been spoken of as possessing antagonizing powers to phthisis. My own impression is, however, simply this: the winters there, having once set in, are continually cold, the thermometer rarely rising to the thawing-point; and this comparative equability of temperature, together with the novel effects of an entire change of residence, may in some cases be productive of good to men; to women they would be positively injurious. The numerous inconveniences resulting from a prolonged winter in a distant locality would entirely counterbalance any imaginary good, and even with men I look upon the change of climate, from a moderate one to a very cold one, as attended with so many disadvantages that I never recommend it. The belief that good might follow from it has evidently originated in the circumstance that phthisis seems to be less frequent in very cold than in temperate climates.

It is difficult to point out the precise spot which is most suitable for the winter residence of a consumptive patient. Many physicians differ with perfect good faith as to the relative advantages of the different places which they recommend. The Island of Cuba, Santa Cruz, the West India Islands in general, and Florida, are most in fashion with invalids from the United States. Madeira

is much resorted to by those from England, and, to some extent, by Americans; and various parts of the South of France, of Italy, and the shores of the Mediterranean generally, are preferrred by the continental nations. A full account of the various advantages of many different situations will be found in the work of Sir James Clark, in which the subject is treated at length. My own advice is regulated very much by the peculiar circumstances of the patient, his willingness or his desire to undertake a distant sea voyage, and his pecuniary means. All of the different localities have some advantages, and require a careful examination before directing positively as to their choice. But it is not expedient to recommend any one situation to the exclusion of others,—still less is it expedient to advise a change of residence, even for a season, or a change of occupation, except upon strong grounds, and in cases where no harm at least will ensue.

The treatment specially intended to prevent the growth of tubercles being very limited in its action, we are obliged to resort to collateral measures, which act rather upon the intercurrent diseases which favor the development of tubercle than upon this product itself. These intercurrent diseases are for the most part of an inflammatory character, and, as already mentioned, precede or accompany the tuberculous deposit. Those which precede it do not require any special treatment: but we must watch their termination, for the greatest danger is to be feared just at their close. Hence in long protracted inflammations of the larynx, trachea, or bronchial tubes, and in severe and repeated attacks of pleurisy, the treatment should be continued until the disease entirely disappears, and the restoration of the patient to his former health is complete.

In these cases, too, it is very necessary to avoid the persistent use of depletory measures, or of any other mode of treatment calculated to break down the constitution. We are all now aware of the connection of phthisis with a debilitated state of the general health; and thus a prolonged antiphlogistic treatment often becomes highly injurious, particularly in inflammation of the respiratory organs. Caution should therefore always be used in the management of even decidedly inflammatory cases; a depletory practice should be carried on only long enough to produce a dimi-

nution of the active symptoms, and never persevered in until the general health should be much deteriorated. These cautions as to the treatment of these inflammations are very important, and must strike every one who has been in the habit of observing many cases of pulmonary disease.

The intercurrent inflammations of the chest are more difficult to combat, because the tuberculous matter is actually developed, and the directly antiphlogistic treatment must be less continued. Of these inflammations the most common is that of the bronchial or tracheal mucous membranes; most of the tickling and cough depends upon this, and a large portion of the sputa comes from the same source; hence the patient is solicitous to quiet the irritation, and the physician is constantly tempted to resort to opiates and other palliatives. It is often necessary to give opiates—that is, if the patient be unable to sleep, the cough must be allayed; and if the tickling and irritation be incessant during the day, it is necessary to quiet them. Still, opiates are essentially disadvantageous, and in most cases they should only be resorted to if other means fail, and then in small doses, so as to preserve the stomach in as healthy a condition as possible.

Hyoscyamus is preferable with some patients to opium—that is, if it tranquilize the cough, for it will not do so always; a mixture may be made of an ounce of the sirup of Tolu, the same quantity of the sirup of senega, and six grains of hyoscyamus, with four ounces of gum-arabic mucilage. Half an ounce of wine of ipecacuanha may be advantageously substituted for the sirup of senega in many cases, especially if there be much fever. This quantity may be taken in the course of three days, a tablespoonful at a time. In this dose it is well to watch the effects of the hyoscyamus, for at the end of one or two weeks it will occasionally produce some symptoms of narcotism.

The opiates most used are the salts of morphia and the elixir of paregoric; on the whole, the former are preferable, but the quantity should not exceed a quarter or a third of a grain, given in divided doses during the twenty-four hours: with many patients it is best to give a small quantity of morphia at night without any other substance, but in most instances the cough is soothed by the combination of a mucilaginous vehicle and of an expectorant.

As expectorants, we may use the sirups of senega or the wine of ipecacuanha, and very rarely antimony; the latter is best fitted for those cases in which there is much fever, and in some instances no inconvenience follows; in others the stomach rejects all remedies of this class. There is in fact no expectorant used in the treatment of bronchitis which may not occasionally be given in phthisis; even the balsam of copaiba is sometimes of great benefit when there is much chronic bronchitis and but little fever or gastric irritability. In most cases, however, it is much too irritating.

Venesection is rarely requisite in pneumonia attending consumption, and is almost never indicated in the accompanying bronchitis. Cupping is however of signal benefit in the treatment of both inflammations. Intercurrent pneumonia in most cases does not need any other remedy; where an internal medicine is necessary, minute doses of tartarized antimony are much to be preferred to large ones or to mercurials.

The treatment of intercurrent pleurisy is more difficult. The intimate relation of this inflammation with phthisis has already been explained, and it seems a matter of more urgent necessity to remove it completely at as early a period as possible. For this purpose the usual antiphlogistic measures are indicated at the beginning of the disease, with small doses of antimony and opium, or Dover's powder, or one of these remedies combined with digitalis, according to the strength of the patient.

After the acute stages have passed off, the surest remedy is the repeated application of small blisters to the affected part, from two to three inches square, so as to keep up a continual counter-irritation by changing the place of their application and renewing them as often as they heal. Large blisters are better adapted to the acute than the chronic forms of pleurisy.

It is often a question whether mercurials should be given under these circumstances; it is true that they produce an injurious effect upon phthisis proper; but when the inflammation of the serous membranes predominates very much over the scrofulous tuberculous type peculiar to the disease, mercury may be given with discretion. That is, the circumstances proper for its employment are almost limited to the pleurisy of commencing, not of advanced phthisis; and it does not seem to matter much whether the pleu-

risy be of that variety in which the tubercles are developed in the serous membrane, or whether they are formed afterwards in the substance of the lung. If we decide upon giving mercurials they must be limited to very small doses, and should be given for a short time only, never producing ptyalism.

The tuberculous pleurisy, in a very chronic form, is sometimes attended with severe but wandering pains over the front of the chest. These pains are sometimes spoken of as a mere inconvenience; at other times they produce an acutely painful sensation. When they recur with sufficient violence to attract notice, it is necessary for the comfort of the patient to relieve them. It is in these cases that the small blister already spoken of will be found useful.

I also frequently apply blisters in ordinary cases of phthisis, in which there is no evidence of any actually existing pleurisy. They are powerful counter-irritants, sometimes seeming to check the progress of the tubercular disease by antagonizing intercurrent inflammations; at other times they act as drains, in that way producing much the same effect upon the system as sometimes occurs naturally in an external scrofulous inflammation or in fistula in ano. The rule which, however, is laid down as to the size of blisters in phthisis ought never to be lost sight of; if one larger than the diminutive one I have directed be applied, harm will more frequently result from it than good, large blisters debilitating patients by their after-effects more than they relieve the internal disease by their revulsive action.

The ordinary intercurrent inflammations must be treated as the same disorders would be if in an uncomplicated state. But gastritis and hæmoptysis, or tracheitis, require a passing notice. If the gastritis occur in a healthy individual in whom phthisis afterwards declares itself, there is nothing special in its management, but it often occurs in those who have previously offered the signs of a scrofulous diathesis and is then difficult to treat. We must then look to the constitutional character of the disorder and must place the patient upon general alteratives, especially the hygienic, as a sea voyage or a journey, while we resort to the usual treatment for dyspepsia.

Gastritis often occurs in the advanced stages of phthisis in

patients who offer, when examined after death, certain changes. That is, the mucous membrane of the stomach is softened; its capacity is enlarged. These are cases which often demand considerable attention; we are sometimes obliged to give up or diminish very much the use of stimulating food or drink, and place the patient upon mild but nutritious articles of diet. Sometimes, but rarely, counter-irritants applied over the stomach are beneficial. The internal remedies which I have found most useful in this variety of disease consist mainly in lime-water after every meal, sometimes conjoined with tonics, which should be given before food is taken. The disease in the last stages of phthisis is, however, always difficult to treat, and offers a very unfavorable set of symptoms.

Laryngitis is often a mere symptom of phthisis, and if it occur in its advanced stage, opiates will scarcely succeed in palliating the distress which is caused by it; the difficulty of deglutition and the uneasy feeling at the throat often constitute one of the most disagreeable symptoms of advanced phthisis. But the commencing laryngitis is sometimes arrested readily enough when no tubercles are yet developed. Repeated but small applications of leeches, followed by frictions with iodine ointment, and the internal use of the solution, are the most important means. A blister behind the neck is much less certain; sometimes it is applied in front of the larynx, but little benefit results from it except in the early stages.

I have not used nor seen employed the cauterization of the larynx, by injecting a solution of nitrate of silver into it from a small syringe more than half full of air, so as to break the little stream into numerous fine drops. Dr. Trousseau gives some favorable accounts of its success; but I am not inclined to think that it is applicable to many cases. The pharyngitis which sometimes precedes phthisis is more easy of cure, and requires local alteratives with a general tonic treatment. When the disease is nearly removed, cold ablutions of the neck and upper parts of the breast are the best means for preventing its return. Of late years, however, I have often applied the strong solution of nitrate of silver with a sponge to the upper part of the larynx, and with very beneficial results.

There are many symptoms in phthisis which are not connected with proper inflammations, but may reach a sufficient degree of intensity to require special treatment. These are the diarrhœa, hectic fever, and night-sweats. Diarrhœa and dysentery often result from proper inflammation of the bowels, and are then nearly similar to the same disease as it occurs under ordinary circumstances. But diarrhœa assumes two other forms; it may be the proper tuberculous diarrhœa which follows the softening of this substance in the follicles of the intestines, especially the glands of Peyer, or the colliquative diarrhœa which occurs late in the disease and sometimes carries the patient off very rapidly.

The former variety of diarrhœa may be palliated by small doses of opiates; the latter requires the same treatment, but with less prospect of success; for when colliquative diarrhœa supervenes in the last stage of phthisis, it is almost always fatal. The astringents may be advantageously combined with opiates, especially kino or tannin, and given in small quantities, if the tongue is not dry and red, and they are not productive of gastric uneasiness. If the diarrhœa be moderate, and the pectoral symptoms have abated upon its occurrence, it is better to abstain from any active medicines, as the discharge is then to a great extent a natural drain, and more mischief would follow from its repression than could be compensated for by the temporary relief of the patient. At the beginning of the diarrhœa small doses, about two or three drachms, of the spiced sirup of rhubarb will often relieve it.

The diarrhœa of phthisis is generally a perfectly manageable symptom. My usual plan is to put the patients at once upon opium, combined with an astringent; say a quarter of a grain of opium and two grains of tannin, every two or three hours. The dose must, of course, vary in different cases. I am also attentive to the diet of the patient. After two or three attacks of this intercurrent diarrhœa have been relieved by this treatment, the patient will often be entirely protected from any recurrence of the symptom. In other cases, however, a tendency to diarrhœa at least continues throughout the whole course of the disease, and requires constant watchfulness on the part of the physician.

The treatment of inflammation of the pharynx, and to a certain

degree of the larynx, is a matter of no little importance, whether it be connected with phthisis or not. Pharyngitis very often occurs in patients who have no tendency whatever to tuberculous disease; and in whom consumption is of equally rare occurrence as in persons in perfect health. In these cases the pharyngeal inflammation is readily relieved for awhile by applications of nitrate of silver; but it is unfortunately very apt to recur again upon slight exposure. It is almost always permanently cured, however, after a few repetitions of the treatment. For these patients I always employ the nitrate of silver in the dose of forty grains to the ounce of water, applied with a camel's-hair pencil instead of a sponge. This mode of application will be found much more easy and free from the inconveniences which it is impossible to avoid if a sponge be introduced into the pharynx.

Laryngitis, however, particularly when it occurs subsequent to phthisis, is more difficult to treat. I do not, I confess, advise the mode of introducing nitrate of silver into the cavity of the larynx, as recommended by Dr. Green, of New York. The operation is perfectly practicable; but in many cases it is evidently entirely inappropriate. The cavity into which the probang is to be introduced is so extremely small that more inconvenience would result from the mechanical irritation than good would result from the effect of the nitrate of silver. Such is at least my conviction, after a good deal of experience in the use of this remedy.

The sweats, which are so frequent in phthisis, are extremely exhausting to the patient, and occasionally require special remedies. The sweating is sometimes connected with the irritative form of early phthisis, or follows the hectic which occurs only in the advanced cases. In other cases the sweating is a termination of a febrile paroxysm, and is in itself a mode of relief to the patient; but as it is a cause of great depression, and often prevents sleep, we are frequently compelled to resort to some efforts to check it. Several external applications have been proposed with this view, such as bathing the skin with a solution of alum, or some other astringent application. They sometimes succeed; but any external application intended to suppress what may be considered as a natural discharge is fraught with danger; and whether this be sweating or the secretion from a cutaneous erup-

tion, external astringents should, if possible, be avoided. It is much better to use no external means other than rendering the clothes as light during the period of fever as they can be made with safety to the patient.

Another useful means of moderating the night-sweat is anticipating it. That is, the patient may take a hot pediluvium early in the evening, while he is still laboring under fever, and then go immediately to bed. The sweat will generally follow, and he should rise as soon as it diminishes and change his linen, and, if possible, the sheets of the bed. In this way he is almost sure of obtaining some hours of refreshing sleep. This remedy, however, like all others under similar circumstances, will fail after a time.

The internal remedies used for the same purpose are notoriously uncertain. In fact, their administration is almost entirely empirical, and the most opposite medicines will sometimes succeed. That is, a remedy which produces a certain action upon the secretion of the gastric mucous membrane has generally a reciprocal action upon the cutaneous surface, and very different substances applied to the gastric membrane have the power of so modifying the condition of the whole body that sweating is for a time suppressed. The most used of these remedies are the acids and alkalies, especially the former. The nitric or sulphuric acids are generally preferred to any other, especially the elixir of vitriol or aromatic sulphuric acid; this should be given in doses of from ten to twenty drops two or three times daily, either in some sweetened water, or in an infusion of the bark of wild-cherry. Sometimes this remedy is disagreeable to the stomach, and produces various ill-defined sensations: it should then be discontinued, and a remedy of an opposite kind resorted to.

The alkalies often answer well in such cases, especially lime-water, with milk, in various proportions, as may be found to suit best with the stomach of the patient. This combination may be taken with some simple biscuit as a suitable article of food, when the stomach digests with difficulty. It should not, however, be used merely as an article of food, but be taken at different times throughout the day. Although it may seem singular that alkalies and acids are both of occasional benefit in the treatment of phthisis, yet it is what is often observed in ordinary cases of dys-

pepsia, in which the condition of the membrane of the stomach is not very dissimilar to that in phthisis; and the same causes which render these different remedies of service in the former case appear to do so in the latter. At least this is the most reasonable explanation.

The chills of hectic fever are often extremely severe, and occur with such regularity that the sulphate of quinine has naturally enough been proposed as a remedy. Given in doses of from four to six grains before the expected chill, it will generally arrest it; sometimes it fails entirely, and is rather irritating to the patient than the contrary.

There are several remedies which at one time enjoyed a reputation in the treatment of consumption which is by no means merited. The principal of these are digitalis, hydrocyanic acid, and the acetate of lead. Digitalis was given mainly because the excessive frequency of the pulse, which constitutes so prominent a symptom in many cases of phthisis, cannot be reduced by blood-letting, while it will sometimes partially yield to the former remedy. The powers of this medicine extend no further; and as the good results of it are extremely doubtful, while it is often positively mischievous, it is now almost abandoned. I have from time to time made a trial of its virtues, but without satisfactory results.

Much was expected from hydrocyanic acid when it first came into use. It is certainly a good sedative; but as the remedy is necessarily extremely uncertain, and is attended with no little danger when the strength of it happens to be greater than usual, it is, in fact, not much prescribed. I do not, however, object to it, as it is unquestionably a good anodyne. The ferrocyanate of potassa is occasionally a good remedy, possessing some sedative powers, and to some extent controlling the night-sweats: the dose which I prefer is five grains three or four times daily, gradually increased to twice that amount, should no effect follow. One of the advantages of the wild-cherry bark certainly arises from the proportion of prussic acid which it contains: this is sometimes considerable enough to cause some fever, and a disagreeable sensation of fullness in the head.

The acetate of lead I have rarely used in the treatment of

phthisis proper, although it is recommended for its power in checking the hectic fever. But in the diarrhœa which often occurs, it is one of the most useful remedies, given in combination with a small dose of opium—that is, in doses of two grains with a quarter to half a grain of opium four or five times daily.

The chalybeates are occasionally resorted to in the treatment of phthisis, especially the iodide of iron, which is given in doses of from ten to thirty drops of the solution two or three times daily. Few patients will bear larger doses, which are apt to cause nausea and a disagreeable feeling of constriction at the epigastrium and head. My own impressions are less favorable to this remedy than they formerly were; it certainly acts well in some cases, but fails entirely as a curative agent, and from its aptness to cause the disagreeable symptoms just referred to, it cannot be given in as large doses or as frequently as would otherwise be desirable. It differs a little from other chalybeates, and possesses more decidedly alterative properties. Other forms of the same class of remedies are occasionally resorted to, and, like the preparations of iodine, answer best when the patient is depressed, with little or no febrile excitement, and the constitution is feeble and deteriorated.

The chalybeate which I have been for some years most in the habit of prescribing, in phthisis or in other affections, is the iron per hydrogen. Of course, when this is well prepared, it is iron given in the absolutely pure state. A couple of grains of it may be given two or three times a day; if, however, it oppresses the stomach, it should at once be thrown aside in the treatment of phthisis.

A variety of vegetable tonics is sometimes of service in cases of phthisis. The best by far I consider to be the simple infusion of quassia, given in quantities not exceeding a wineglassful before each meal, and of such a strength as not to be exceedingly bitter. Other vegetable tonics, however, such as gentian and the like, may be substituted for the quassia when the patient has become wearied or disgusted with this remedy.

Another mode of treatment of consumption is by the use of alcoholic preparations. These medicines, for such they strictly are, must be directed in phthisis with the same end of doing good to

the patient as quinine or cod-liver oil. It is true that there are some persons so unfortunately constituted by nature that it is impossible for them to use alcoholic drinks of any kind, without running the risk of becoming drunkards. In like manner, there are many women who become victims to the inordinate use of opium after it has been directed in the first place for the relief of some painful disease. The question then of course arises to us, ought we to abandon the use of these medicines because some individuals may indulge in them to an inordinate extent? Or ought we not rather to prescribe them whenever we believe that decided good results from them, taking care, however, to guard the patient, as far as lies in our power, against their abuse?

The question next to be decided is, does alcohol exercise an antagonizing effect upon consumption? My experience in the management of these patients, which now extends over many years, has shown me conclusively that this is the case. Besides that, it is a matter of daily observation that patients who have been in imminence of tubercular disorder, have often apparently entirely warded it off by the moderate but prolonged use of some alcoholic stimulants.

The kind of stimulants to be directed must vary according to the different cases. Porter, or any other form of malt liquor, is often borne well; and while it increases the tendency to the formation of fat, certainly seems to antagonize tubercles. This remedy should be given in moderate doses; about two tumblers a day, and may be often persevered in for a good while. Sometimes wine may be given in moderate doses as a habitual article of food, which often has a powerful influence as a prophylactic against the disorder. Even in young persons, who are strongly disposed to phthisis, I sometimes direct this remedy to be used; sparingly, however, and always with the patient's food.

The last question to be decided is as to the use of distilled liquors, such as brandy, whisky, and the like. These also act much in the same way as wines or malt liquors; sometimes, however, they agree better with the stomach, and may be used with great benefit to the patient. The only disadvantage belonging to this class of remedies is the one to which I have already alluded; but where there is a doubt between the possible danger of an individual be-

coming too fond of alcoholic drinks or falling a victim to pulmonary consumption, I am decidedly of opinion that the latter is the greater evil; and I do not hesitate often to advise patients to take a small portion of brandy or whisky two or three times a day; taking care, however, to lay before them the miserable effects which would follow from acquiring the habits of intoxication. With this caution, I am convinced that no mischief need result from advising a remedy against consumption which I am certain is one of the most powerful at our disposal.

The question of using alcohol occurs not only as a prophylactic against consumption, but as a remedy in the course of the disorder. When there are abundant sweats and rapid emaciation, a little malt liquor, or sometimes a portion of wine or spirits, may be given with advantage, throughout the greater period of the disease. There are cases, however, in which all stimulants produce an increase of fever and augment the discomfort of the patient; of course, under these circumstances, they should be at once abandoned.

The antagonizing effect of alcoholic stimulants upon phthisis is not universally admitted, although the weight of authority certainly agrees with the view of the subject which I have just given. Dr. Bell, of New York, in the Fiske Fund prize dissertation of the present year, just published in the October number of the *American Journal*, has written a very good essay upon the subject. The conclusions he gives are that alcoholic liquors do not prevent consumption, but that they seem to predispose to it. I must confess, however, that his conclusions do not appear to me to be borne out by the facts which he details, although it is perfectly true that neither the moderate use nor the abuse of alcohol will always prevent consumption; still my own opinion agrees with that of most physicians, that this remedy has a decided power of prevention in many cases.

The food of patients affected with consumption is a matter of no little importance. I am always accustomed to give them as nutritious a diet as they can digest, unless there is an intense tendency to hæmoptysis, or to some intercurrent inflammation. In these latter cases we must of course moderate the stimulating character of the food. But, as a general rule, I direct for these

patients animal food, such as beef, mutton, or venison, to be taken at least once a day, or oftener if the patient can digest them. Sometimes white meat, such as chicken or turkey, answers well. Ham and salted pork are very well fitted for consumptives, if the stomach is able to digest them; especially the fatty parts of this kind of food. Eggs, oysters, and all other nutritious articles, may also be given. The difficulty, however, in directing the food in phthisis arises from the fact that it is necessary to select an hour for the principal meal when the patient is best able to digest it. Thus I am accustomed to vary the time of their dinner entirely according to the fancy of the patient: for he is generally able to select a time at which he suffers least from oppression after eating.

There are certain mineral waters which have acquired more or less celebrity in the treatment of phthisis: among these are some of the springs in the Pyrenees, and the Red Sulphur Springs in Virginia. These are all situated in mountainous districts, which render the climate injurious to many classes of phthisical patients. In advanced cases the benefit, if any result, can be but palliative; and the circumstances attending the geographical position of the springs, and the long journey necessary to reach them, should be taken into the account before advising patients to resort to them.

My own experience as to their virtues is limited to a short residence at the Red Sulphur. This is a cold and very agreeable water, containing very little saline substance, and impregnated with a moderate quantity of sulphureted hydrogen. The most benefit was derived by patients who were in need of an alterative, especially of one which was capable of acting upon the digestive canal. Such cases appeared to derive essential benefit from the combined influence of the water and the journey; and in this way, at least, it appears to be serviceable in commencing phthisis, where the irritability of the chest is not great, and there is little or no tendency to acute bronchitis, to hæmoptysis, or to pleurisy. In the latter cases the climate does not appear to me very favorable, at least not in a wet summer, when the situation of the springs renders them a damp and cold residence.

Since the above remarks on mineral springs in the treat-

ment of phthisis were written, I have paid a second visit to these watering-places, and besides that the attention of the medical world has been drawn to the subject by the reported successes of Priessnitz's practice. I have arrived very nearly at these conclusions respecting them: The Red Sulphur water is of a very feebly medicinal nature; it contains scarcely any active ingredient, but the water is rendered a little more digestible by the small quantity of gaseous material which it contains. Patients when drinking it freely, therefore, imbibe little else than a large quantity of digestible water; sometimes, in the early stages of phthisis, this is of benefit, diminishing the pulse, and of course the fever. Besides, the advantages resulting from a change of locality, air, and exercise, all coincide with the good effects derived from the water.

It is necessary, however, for patients to take it in considerable quantities, if they would derive any benefit from it; but they should be careful not to overload their stomachs so as to interfere with the digestion; this may sometimes dispose to hæmorrhagia. Those who visit them in the advanced stages of phthisis are not usually benefited. Some patients are foolish enough to attempt a long journey when their strength is broken down, and of course sometimes die soon after visiting the springs; in this respect they are like those individuals who hope, by passing the winter in a tropical climate, that they will escape death when it has become imminent.

The water-cure may possibly have been beneficial in some rare cases; but this mode of treatment, when applied to phthisis, is so irrational that scarcely any physician can be found to recommend it. The best results from it as regards consumption, seem to depend upon the ingestion of large quantities of water, and not upon the soaking in wet sheets, which I should think productive of much more harm than good. I have occasionally found, however, that patients affected with phthisis, from a fancied hope of benefit, have in a slight degree used the hydropathic treatment—that is, they have applied wet bandages around the chest or throat, with a full belief of receiving advantage from them. I cannot, however, say that I have seen any decidedly good results from it; but occasionally some patients were to a slight degree relieved—that is,

the wet towels, when applied to the body, soon lose the sensation of coldness, and the application itself becomes a counter-irritant, frequently bringing out eruptions of boils, and in that way producing imperfect effects, something like those of a blister.

Glycerin has of late years been recommended by some as a substitute for cod-liver oil. I must confess, however, that I have seen no evidence in its favor sufficiently strong to induce me to give it a trial. It is one of those remedies which, like naphtha, is in all probability to be well spoken for a few years, and then abandoned. Its action has been supposed to be analagous to cod-liver oil, and it is given in the earlier stages of phthisis.

The treatment, therefore, of phthisis is almost entirely indirect, and we hope to check the progress of tubercles by removing accidental complications, or diseases and conditions of body which favor their growth, rather than by acting directly upon the tuberculous secretion. It is therefore necessarily uncertain, and often fails when everything seems to be most promising; for as tubercles themselves are manifested by but few symptoms, the greatest part of the sufferings of the patient is caused by the complications. These are often readily removed, and the patient is apt to mistake the apparent amelioration in his symptoms for a real improvement of the disease.

But though the fatal cases constitute a large majority of those in which phthisis is tolerably advanced, or has from the first assumed a character of great severity, yet there is so much left for the physician to do as a faithful counselor in warding off the first approach of the constitutional disorder by appropriate hygienic and medicinal measures, as an active practitioner in checking the progress of the varieties to which inflammation of the organs plays a decided part, and lastly, as a watchful friend in allaying the sufferings in those cases which are actually incurable, that the treatment of consumption is far from being as ungrateful a task as is often supposed. How far the power of therapeutics extends, is difficult to define with accuracy, but the gradual increase of our knowledge will probably furnish us with means which are of more certain application, and will teach us how far the use of those we now possess may be extended.

The exercise of the lungs themselves should not be forgotten as

one of the best methods of resisting pulmonary phthisis. Should the patient be in the habit of reading or speaking aloud, I have not in general forbidden the exercise, provided it was not carried to the point of fatigue, and there was no active inflammation going on. This was the case with a well-known and popular preacher in the Methodist Church, who consulted me nearly thirty years since, with cavities actually formed, and who still fulfills his laborious duties with passable health. The exercise may in some cases be increased by protracted efforts of inspiration, but much caution is then necessary to avoid increased irritation. A mode of exercise of this kind constituted the basis of a plan of treatment which attracted some notoriety in London a few years since, but was strongly tinctured with charlatanism, and its results were evidently much exaggerated, so that its actual value was soon ascertained to be extremely limited.

When patients are simply threatened with phthisis, without any actual development of the disorder, and especially in those cases in which a strong hereditary predisposition exists. I have thought that there was considerable advantage in the patient frequently taking full inspirations, so as to dilate the chest and increase the capacity of the lungs. He should, when inspiring, throw his shoulders well back, and inhale strongly, retaining the air for a certain time in the lungs. This exercise may be repeated several times, at different periods of the day; it should be resorted to in those cases in which there is no tendency to hemorrhage. I regard it as possessing a twofold action: in the first place, it increases the quantity of air inspired, and strengthens the muscles of respiration; in the second place, it tends to favor the development of emphysema, a disease which, as already mentioned, may be regarded as in some degree antagonistic of phthisis.

CHAPTER XIV.

PNEUMOTHORAX—ANATOMICAL CHARACTERS—SYMPTOMS AND PHYSICAL SIGNS —DIAGNOSIS AND PROGNOSIS—DURATION AND TERMINATION—TREATMENT.

THERE is a lesion of the lungs and pleuræ which is rather a result of previous disease than an independent morbid action. This is pneumothorax, or perforation of the lung. It is true, that as soon as this accident occurs pleurisy is set up, and only differs from common inflammation in the mingling of the symptoms of the pleurisy with those of the perforation. The mechanism of perforation is very simple; in almost every case it results from tuberculous disease of the lungs, but any alteration of those organs situated near the pleura, and gradually destroying the parenchyma beneath it, may produce the same result. As soon as the pleura is left unsupported by the tissue of the lungs, it becomes of a dull white or yellow color, and soon sloughs; a small hole forms in the center of the dead portion, which is enlarged by the passage of air through it during the act of inspiration. The size of this opening varies from that of a pin's head to a third of an inch in diameter; it is generally of a valvular form, and allows with difficulty the return of the air from the pleura. As the air enters more easily than it passes out, it of course accumulates in the cavity, and the chest quickly increases in volume, from the quantity of atmospheric air which finds its way into it.

The air is an immediate irritant to the serous membrane, and gives rise to inflammation, which is followed by the secretion of its usual products, lymph and serum. The latter accumulates at the bottom of the cavity, mixed with a few flocculi of lymph, but the greater part of this substance adheres to the surface

of the serous coat in the form of a false membrane, which extends to the point of perforation; and in fact, after a time, closes it completely; in which case there is no difference between empyema and advanced pneumothorax. The liquid contained in the pleura is at first merely serum, but it afterwards is replaced by pus, which is secreted by the false membrane, as in chronic pleurisy.

Physical signs. As pneumothorax is a physical lesion which produces a rapid change in the condition and functions of the viscera of the chest, its physical signs are very evident, and are often beautiful illustrations of the accuracy of physical exploration. The immediate result of the passage of the air into the cavity of the pleura is the collapse of the lung; the inspiratory murmur therefore very soon diminishes, until it finally ceases, or is replaced by amphoric respiration, which is often heard over the whole cavity, and in other cases is limited to the part nearest the perforation; the sign is much clearer and sharper than in those cases in which it is caused by a cavity in the substance of the lung, for the walls of the chest are more elastic, and produce a clearer sound than those of an ordinary cavity. The expiration, however, is often unheard, for the opening is in many cases too small to allow the air to pass out with sufficient freedom to give much sound. In this respect the amphoric respiration in pneumothorax resembles that of very large pulmonary cavities.

The amphoric respiration often ceases after the pus has increased, and the coating of lymph has formed over the opening; and there is then either no sound, or a slight and bronchial respiration is heard at a distance near the root of the lungs.

As a necessary attendant upon the amphoric respiration, we find a corresponding resonance of the voice, which follows the same course, and ceases at the same time. The metallic tinkling is another phenomenon of equal interest. It resembles the tinkling of a pin against the sides of a glass or metallic vessel more nearly than anything else; and was at one time supposed to depend upon the dropping of a small portion of liquid from the top of the pleura upon the surface of the effusion. Dr. Bigelow, of Boston, performed a number of experiments upon the dead body, and satisfied himself that the cause of the tinkling depended

upon the air forcing its way upward through the liquid, and not in the dropping from above. The tinkling is by no means a constant sign, and is, therefore, much less important than the amphoric respiration and resonance of the voice.

The signs of pneumothorax gradually decline as it passes into ordinary empyema, and there is then necessarily flatness of percussion, with entire absence of respiratory murmur.

I have never witnessed, in any ordinary pleurisy, so large an accumulation of pus as I have in two cases of pneumothorax. In one of these cases I estimated the quantity as about two gallons; in the other there was more than half as much. Of course, for the pleura to contain so large a mass of liquid, it is necessary for ts cavity to be considerably dilated, and the lung entirely compressed.

When pneumothorax gets well, as happens occasionally, although rarely, it does so by the following process. In the first place, there are generally instances of local pneumothorax, in which the greater part of the pleura on the affected side is already shut up by adhesions, leaving but a small part into which perforation can occur. When this accident does take place, the usual physical results follow; but the signs of pneumothorax are limited in extent to a part of the side of the chest. It is followed of course by the usual secondary pleurisy, and the opening not being subjected to the violent strain which takes place in ordinary pneumothorax, is of course soon completely closed. The liquid is then gradually absorbed, as in an ordinary case of pleurisy, into which the pneumothorax is resolved; and thus the patient will sometimes get entirely well, with this secondary lesion.

In ordinary cases of pneumothorax, death takes place from the fact that the patient is generally laboring under advanced tubercular disease in the other lung; the pleura on the side which is affected covering the lung in which there are comparatively few tubercles, there is no development of preservative pleurisy. That pneumothorax is not in itself a fatal lesion, is sufficiently evident from the history of wounds of the lung; from which patients frequently recover, notwithstanding the same physical conditions precisely have been produced as in perforations of the lung from softened tubercle. We should not therefore carelessly pronounce

a case of pneumothorax to be necessarily fatal; still less so that its fatal termination is to be looked for immediately; for these cases will sometimes last many months—that is, if the tubercular disease in the opposite lung, which organ is alone capable of sustaining respiration, is not much advanced.

After pneumothorax has occurred, there is of course an expansion of the chest; in fact when the pleura was perfectly free from adhesions before the accident, I have seen the side of the chest as much dilated as it ever is in cases of chronic pleurisy. When percussed, it of course yields a very clear sound, with a peculiar resonant intonation very different from that ever yielded by the healthy chest.

In the same manner, in what may be called local pneumothorax, in which the quantity of air is limited by old adhesions of the pleura, the sound on percussion is also clear at the part where the air exists. In these cases, however, the excessive sonorousness is less marked than it is in cases of what may be termed general pneumothorax, in which the whole pleura is distended with air; for we must not forget that the percussion is most resonant when there is a large quantity of air as well as when it is near the surface.

After pneumothorax has existed for awhile, there is a gradual development of dullness of sound. This arises from the exudation of lymph and serum into the cavity; the dullness gradually increasing in extent until the whole quantity of air extravasated becomes replaced by the denser fluid. In these more advanced cases, too, we find that a large effusion of pus has taken place, which thus converts the pleura into an immense pus-containing cavity exactly as occurs in an ordinary empyema. Of course the percussion then, instead of being preternaturally clear, becomes perfectly flat over the whole of the effused pleura.

Symptoms. The rational symptoms of pneumothorax are by no means conclusive, but in most cases they are sufficiently well marked as at once to excite a suspicion of the nature of the accident. They are the usual signs of acute pleurisy with extreme and sudden dyspnœa, from the rapid entrance of air into the cavity of the pleura. Their uncertainty arises from the occa-

sional absence of pain in cases of acute pleurisy, and from the dyspnœa not being always very intense.

As a general rule, however, if a patient laboring under symptoms of phthisis be taken with very sudden and acute pain in the chest, and extreme dyspnœa, there is strong reason for suspecting that perforation of the pleura has taken place; especially if the pain occur during an effort of coughing, or some other sudden shock given to the chest. It is true, that all of these symptoms may depend on acute secondary pleurisy, which sometimes develops itself, or at least shows itself almost instantaneously. The only certain test is therefore to be sought in the physical signs of the disease, which are alone to be relied upon. The pain is often perfectly similar to that occurring in severe cases of pleurisy. It is cutting or lancinating, and at first prevents the patient from lying on the affected side, but after the disease has continued for a time, the patient follows the ordinary rule of chronic pleurisy, and prefers to lie on his back or on the affected side, in order to avoid the pressure of a large quantity of liquid upon the mediastinum.

The other symptoms are also those of pleurisy; the fever which follows the perforation is of the acute kind observed in cases of pleurisy, with a rapid and rather wiry pulse, followed by abundant sweats at night. After the effusion has become purulent, the fever approaches more nearly to the hectic form, and the patient complains much more frequently of chills than he does in the earlier stages of the disease. Although he gradually loses flesh, he does not become as much emaciated as in those cases in which tuberculous disease is passing through its ordinary course; nor is the disturbance of his general health nearly as great, provided he escape the first dangers of the accident. The other functions of the body are more or less disordered, but in very different degrees and are scarcely similar in two patients. This variety depends upon the different susceptibility of individuals, which necessarily renders all the accidental or secondary symptoms of a local inflammation extremely uncertain and variable, nor can they be described except in general terms, such as are not necessary to characterize the affection.

The symptoms af the original disease causing the pneumo-

thorax in great part remain, but are in some degree modified by it; thus the cough and expectoration diminish when perforation supervenes, for the difficulty of breathing and pain prevent a full expiration, which is necessary to a complete cough. The cough which is proper to pneumothorax, is even shorter and drier than that of pleurisy, for the movement of the chest is less complete and more painful. Of course no expectoration can arise from the pneumothorax; if there be any, it must depend upon accompanying disease of the lungs or bronchial tubes.

Diagnosis. The diagnosis of pneumothorax, since the discovery of physical exploration, is among the most certain of those of diseases of the chest—for in a lesion of this kind the physical signs are pathognomonic; without them, the lesion may be suspected, but cannot be certainly recognized or distinguished from acute pleurisy. Physical exploration goes much further than the mere recognition of the disease; it points out its different degrees and stages, and the gradual passage of it into empyema.

Prognosis. The prognosis is more uncertain; in the large majority of cases it is unfavorable, and speedily fatal; but this rapid termination depends less on the lesion itself than upon the disease which has given rise to it, or on the combined influence of the two. If, for instance, one lung be almost unfitted for respiration, and the perforation should occur, as it almost always does, in that which is comparatively healthy, respiration is almost interrupted, for both lungs are rendered nearly useless, and the patient dies in a few hours or days, from exhaustion and orthopnœa. The condition of the lung which is not the seat of the perforation has, therefore, much influence upon the result. If the patient does not labor under any immediate danger from the interruption to the respiration, the prognosis is still almost necessarily fatal if the phthisis be at all advanced; but if it be confined to a few scattered tubercles it has little influence upon the course of the pneumothorax, which seems rather to retard than hasten the progress of tubercles. If the disease depends merely upon a few tubercles, and arises from the accidental rupture of a small one into the pleuræ, the prognosis is, for the present, much less unfavorable, but after the pleura is completely filled with pus, instead of air, the patient still incurs the risk attendant upon a severe empyema, and, of

course, under the best of circumstances, the prospects of ultimate recovery are extremely doubtful. As a general rule, the prognosis is almost always mortal in general pneumothorax, in which the air occupies the whole cavity of the pleura.

In cases of what may be termed local pneumothorax, in which but a small portion of the pleura is capable of admitting air, the progress of the tuberculous disease giving rise to it is sometimes not much interfered with; a mere perforation of the pleura, with a partial extravasation of air, not producing those severe symptoms which interfere much with life. In these cases then, we may always state that the patient will live about as long as if no perforation of the pleura had occurred.

Duration and termination. The duration of pneumothorax is not fixed. It may terminate fatally in a short period, (in one case I witnessed a fatal termination in less than an hour,) or it may last many months; in two cases I found the fatal termination not to occur until the lapse of fifteen and eighteen months; in the latter of these cases the patient made two long voyages, and, according to his own statement, did full duty as a seaman while his pleura was enormously distended with pus. It is in this variety that the lesion is followed by empyema, and the possibility at least of recovery must be admitted.

In cases which are not very quickly fatal, the duration of the disease almost always extends over some months—that is, it would last as long as a case of purulent effusion into the pleura of the ordinary kind would do. The recovery from the accident is in these cases always slow, but still it gradually takes place.

Treatment. The treatment of perforation of the pleura is extremely limited. The indications are to subdue the secondary inflammation, or rather to keep it within moderate bounds, and to relieve the pain. But as the patient is already much debilitated by previous disease, there is little to be done in the way of active treatment. Bleeding is quite inadmissible, but an occasional application of cups may be allowed, although with great reserve, and only in those cases in which the inflammatory excitement is very high. Blisters are much more frequently of benefit; in fact, they are the most certain remedies for checking the inflammatory action, and often relieve the pain; they should be applied to the

affected side near the seat of pain, which does not correspond in most cases precisely with that of perforation.

Besides blisters, the only remedy which promises much advantage is an opiate, especially the Dover's powders, given in doses sufficient to tranquilize the agitation of the patient; and if not to secure sound sleep, at least to relieve the incessant restlessness and suffering. This treatment I have long pursued in cases of pneumothorax, and it is nearly similar, if not altogether identical, with that recommended by Dr. Graves for the treatment of intestinal perforation in typhoid fever. The opiate should be continued for some days in a full dose, and should be given in diminished quantity during the whole of the case, discontinuing its employment when the oppression increases, or the digestive powers become much enfeebled.

The proper antiphlogistic treatment of pleurisy is scarcely adapted to cases of pneumothorax; for as the cause is a permanent and mechanical one, it cannot be removed by antiphlogistic or alterative remedies, and, therefore, the progress of the secondary pleurisy cannot be retarded; but the inflammation may be modified, and the empyema, which is almost necessary to the cure of pneumothorax, should afterwards, if possible, be brought to a favorable issue.

The operation of ordinary paracentesis is sometimes allowable in two different stages of the disorder, to favor the escape of the gas, or the pus which is afterwards secreted. Immediately after the perforation of the pleura from a softened tubercle, the dyspnœa may suddenly become so great that immediate death is to be feared; the side may then be punctured in the usual way, and the gas be allowed to escape. In this case, however, the subsequent dangers of the disease are certainly increased by exposing the cavity of the pleura so freely to the air, and the operation cannot be justified except it be a measure of absolute necessity; at best, it relieves the patient only for a short time.

In the cases of advanced empyema which follow pneumothorax, paracentesis may be performed where the oppression is extreme, and the intercostal spaces are much bulged out. The operation is, however, very far from being devoid of danger, for the free entrance of the air into the cavity tends to increase the inflam-

mation, and to aggravate the hectic fever. The usual precautions to guard against inflammation should be carefully attended to after the operation.

If it be thought advisable to perforate the chest, the best mode is perhaps one that has been recommended by Dr. Bowditch, of Boston, who states that he has several times performed the operation without difficulty or subsequent suffering to the patient. He uses a very small trocar, and allows the fluid to flow through it; the instrument is too small to allow of the entrance of any notable quantity of air, and in that manner all mischievous results from the operation are prevented. By drawing the skin a little from the ribs, so as to cause it to overlap the wound, it will become almost impossible for the external air to be introduced into the chest in cases of empyema following pneumothorax.

CHAPTER XV.

PULMONARY HEMORRHAGE—DIVISION INTO VARIETIES—MODE OF ATTACK—SYMPTOMS—AND PHYSICAL SIGNS.

HEMORRHAGE from the lungs in most instances consists merely in an exudation of blood from the bronchial membrane, and is symptomatic of deeper-seated diseases of the lungs; but as it arises from several different causes, and may depend upon simple excitement of the circulation, or disease of the heart, as well as upon positive lesion of the lungs, it requires, on some accounts, a separate examination. The connection of hæmoptysis with different stages of tuberculous disease has been already explained in the chapter upon phthisis. I have, therefore, now to treat of hæmoptysis itself, considered as a separate disorder, and not a mere symptom of other pulmonary affections.

It may be divided into the hemorrhage which is purely external, in which the blood comes directly from the mucous membrane, and is discharged externally; and into another variety, in which a portion of the blood escapes into the cellular tissue of the lungs, and forms little nuclei, which are of a deep-red color, and of almost a uniform appearance. These nuclei constitute the disease known under the name of pulmonary apoplexy, which is nothing more nor less than hemorrhage from the vessels of the smaller bronchial tubes and vesicles into the cellular tissue of the lung. It is, in general, attended with a flow of blood externally; but in some cases the effusion is strictly internal, and the disease is then indicated only by the dyspnœa and obstruction to the circulation.

There is some difference as to the causes of the slighter varieties of hæmoptysis and pulmonary apoplexy. The latter follows, in most cases, the sudden and violent congestions of the lung,

which a disease of the heart or aorta naturally produces; or it arises from some other equally decided obstruction to the circulation; but the hemorrhage which finds its way entirely to the surface depends, in most cases, upon a less severe but more persistent cause of irritation, seated in the lungs themselves.

In either variety of hemorrhage there is, therefore, something more than a mere flow of blood to the chest; there is a cause, either general or local, or both united, which determines the raptus toward the lungs, and then a discharge into the cellular tissue, and upon the surface of the bronchial membrane, or upon the latter alone. The first stage in the morbid chain is the congestion which may either occur without the effusion of blood, or with hemorrhage, into the cellular tissue, but not externally. Hence the discharge of blood is in itself of no importance, except in the rare cases in which it is so considerable as to enfeeble the patient very much; the real mischief is the effect produced upon the pulmonary tissue. If there be an apoplectic extravasation, the mischief is more considerable, and the secondary irritation greater than when there is simply an arterial congestion, giving to the lung a bright vermilion-red color. The secondary irritation may be merely a moderate inflammatory action in the part, or there may be in addition a tuberculous deposit; should the latter exist before the hemorrhage, the congestion of the lung is simply a favoring cause, which increases the number and favors the growth and softening of tubercles.

The symptoms and mode of attack of pulmonary hemorrhage may begin in several ways. A patient may be using strong and even violent exercise, which determines a sudden rush of blood toward the lungs, and the hemorrhage then ensues; or it may occur while the patient is perfectly quiet, as for example, when he is lying in bed, usually early in the morning. Either of these modes of occurrence may coincide with tuberculous disease, but the latter is more frequently connected with it than the former. There is no difference in the symptoms of the hemorrhage connected with tubercles or the tuberculous diathesis, and that dependent upon other causes. The cases vary only according to the severity of the bleeding, and the previous health of the patient.

The general symptoms are perfectly the same as those of other hemorrhages; hence they require but little special attention in a chapter devoted to pectoral disease. The heart is throbbing and quick, its contraction is accompanied, in many instances, with a bellows sound, which is extremely loud and strong. As the hemorrhage is almost always of an active character, the face is unduly flushed, and the capillary circulation excited. These symptoms gradually decline after the flow of blood, except the action of the heart and arteries, which remains for a considerable time much excited.

The local or pectoral symptoms are more immediately connected with our subject. If the hemorrhage be slight, the patient complains only of a light sense of tickling at the upper part of the trachea and the large bronchial tubes. If the hemorrhage be considerable, the tickling is more constant and severe, and a sense of oppression is felt across the sternum, which seems to prevent the full expansion of the chest. As the hemorrhage generally lasts for some time before it finally ceases, the tickling sensation continues, and even after the flow of fresh blood has completely ceased the coagula continue to be expectorated, and keep up the same sensation of tickling, with the short irritative cough which naturally results from it. There is no pain from the hemorrhage proper; the pain, if it exists, depends only on the accidental inflammation which sometimes follows the hemorrhage; for the effused blood left in the cellular tissue of the lung may prove an irritating cause like other foreign bodies.

The signs of auscultation are merely a loose subcrepitant rhonchus, heard not only at the seat of the effusion, but throughout the bronchial tubes which contain blood. The bubbles are even looser and of thinner liquid than those formed by mucus. The percussion is rendered slightly dull if there is a large apoplectic extravasation, or much congestion of the surrounding tissue. The evidence of hæmoptysis does not rest, however, upon physical signs, but on the external discharge of blood; and in those rare cases in which the blood is extravasated into the cellular tissue of the lungs without appearing externally, no certain conclusions can be drawn from auscultation.

The course of hemorrhage is rarely toward a fatal termination,

unless the first gush of blood should prove fatal: even this is not common, except in advanced phthisis, when the blood comes from a large vessel crossing a cavity, and is not the result of exudation from smaller vessels and the finer bronchial tubes. This accident is then strictly dependent upon phthisis.

I have seen but very few fatal cases of hemorrhage from the lungs, not more than five or six in all, except in cases in which tubercular cavities existed in those organs; then an abundant hemorrhage is always a most serious symptom; but it does not often cause death except in those cases in which this result is almost instantaneous. I have often seen cases in which patients have been taken with copious hemorrhage, described by their friends as a vomiting rather than a spitting of blood, in which death was extremely sudden.

The *treatment* of hemorrhage from the lungs does not differ materially from that of analogous affections, excepting that it is connected with other diseases of the lungs, especially pulmonary phthisis, in which case the treatment is a mere appendage to that of this disease. There is generally little difficulty in suppressing the bleeding; but after this has been brought about, our object is to prevent its return and check the subsequent fever, which is not only attended with some danger in itself, but is a favoring cause of tubercles.

The patient should scarcely ever be bled from the arm unless there is extreme excitement of the pulse with a full and developed force: but when he is already feeble previously to the occurrence of the hemorrhage, it is by far the best to abstain from venesection. Very often patients are bled much too profusely, so that their strength is to a great degree enfeebled, and the subsequent progress of phthisis is rendered more rapid. Cupping is a most useful remedy; it may be either an adjuvant to general bleeding, or it may much more frequently replace it, when the patient is already much enfeebled.

It is also necessary to place the patient in bed, unless the attack is but slight and he has already frequent returns of it; in the latter case he will generally know that it is not necessary for him to remain in bed. The hemorrhage may often be arrested by a few spoonsful of common salt, which may be given to the patient as

soon as it occurs. The acetate of lead, in doses of two grains every hour or two, with a quarter to an eighth of a grain of opium, should then be given, and may be continued as long as the hemorrhage lasts.

Any other astringent, such as tannin, may be used as well as the acetate of lead. I do not however attach much value to either of these; opium is by far a more important remedy, and acts in the first place by quieting the nervous irritability of the patient, and in the next place by diminishing his fears of a dangerous result, which is often very great with patients in this condition.

The patient should remain perfectly quiet, and not speak, except for matters of absolute necessity, and then only in whispers. The other astringents of a vegetable kind may be in some cases used in place of the acetate of lead, such as the rhatany, or catechu, or kino; but they are much better suited to those cases in which there is merely a slight oozing from the surface of the bronchial tubes than active hemorrhage. The diet must be extremely rigid, and consist merely of small portions of cold vegetable substances, such as sago, arrow-root, and the like unirritating aliment; that is, when the system is not exhausted by repeated attacks of the hemorrhage. The temperature in which the patient is placed should not be high enough to keep up the flow of blood, the room must be cool if possible, and everything capable of producing excitement of the patient, and in this way accelerating the circulation, should be carefully avoided. Ice in small pieces is one of the most valuable remedies; the patient is generally very thirsty, and takes the ice eagerly. Sometimes ice is even applied to the exterior of the thorax in a bladder, so as to act as an external refrigerant which may check the hemorrhage. But this application requires great caution, and should not be carelessly used.

CHAPTER XVI.

TUBERCLES OF THE BRONCHIAL GLANDS—DIAGNOSTIC CHARACTERS—TREATMENT.

THE bronchial glands are, at the early periods of life, more subject to tuberculous deposit than the lungs themselves. This tendency to tubercle exists in the bronchial glands to a much higher degree than in any other of the lymphatic ganglia. It is highly developed in children, but gradually declines as individuals advance in life; and in old age the bronchial glands are scarcely ever affected with tubercles, except as a consequence of previous disease of the lungs. The relative frequency of tubercles in the bronchial glands of children compared with the lungs is not less than five to four, which is of course more than reversed after the age of puberty.

The development of tubercles in the bronchial glands occurs nearly as in other solid structures of the body; scattered points of tuberculous substance are gradually deposited in the structure of the glands, surrounded by the original tissue, which remains for a considerable time nearly in the healthy state; sometimes, however, it is swollen and more vascular than usual, but more frequently it is quite pale, and infiltrated with the gelatinous substance which is in many cases the early stage of tuberculous matter. As the quantity of tubercle increases, that of glandular structure gradually becomes less, until the whole tissue of the gland is absorbed, and is replaced by tubercle. It is then much larger than the original gland, and the capsule which incloses it gradually thickens during the process of softening. After softening has followed, adhesion occurs between the glands and the nearest large bronchial tube, so that the contained matter is evacuated by an opening into it. In most instances, however, no softening occurs, but

the tuberculous matter becomes hard and dry, and is converted into a calcareous substance, surrounded by the capsule. This substance often becomes extremely hard and solid, and generally remains in this state during life. The tuberculous disease of the bronchial glands is therefore much less unfavorable than that of the lungs, and is essentially curable.

The symptoms of tubercles in the bronchial glands are very obscure. Indeed, they cannot in the large majority of cases be recognized except by the signs of a general scrofulous diathesis. As this rarely occurs in children without a deposit of tubercle in the bronchial glands, we may safely infer that the local disease exists, if we discover the symptoms of the general disorder. In such cases no possible disadvantage results from the difficulty of diagnosis, for the disease has comparatively little influence upon the lungs. In other cases the tuberculous glands attain a considerable size, and press upon the trachea, obstructing the respiration, and irritating the bronchial mucous membrane. The symptoms of catarrh, however, differ but little from those of ordinary bronchitis; the cough is frequent, but occurs in paroxysms, very much resembling, in many cases, the fits of hooping-cough, and, on auscultation, it is found that the respiration is extremely feeble in one or both lungs, while the percussion is quite sonorous. The feebleness of respiration is the only permanent sign, and depends upon the contraction of the larger tubes from the pressure upon them. The expirations are at times wheezing, and, as it were, protracted, but not permanently so. As these are the only symptoms of tubercles of the bronchial glands, and are by no means limited to this lesion, the certain diagnosis depends at last upon the comparison of these comparatively unimportant local signs with the general indications of a tuberculous diathesis.

The treatment of tubercles of the bronchial glands consists entirely in those means which tend to counteract the scrofulous or tuberculous diathesis; we therefore trust greatly to the use of iodine and vegetable alteratives. The use of these remedies should be continued for a long period, if the stomach of the individual be not irritated by their employment; if it should be, they must be immediately discontinued, and, after a time, renewed;

free exercise in the open air, and a healthy invigorating diet, are necessary adjuvants in the treatment.

Another remedy of the utmost importance is found in the chalybeates. In whatever form iron may be given, it produces very nearly the same result; but I usually prefer on the whole administering it in the form of iron per hydrogen—that is, pure and uncombined. In children who are supposed to be affected with tuberculous disease of the bronchial glands, this should be given for a long period. The dose is one grain twice a day; sometimes it may be conjoined with other tonics, such as a grain of quinine, or some other bitter preparation. These children are often much benefited also by a course of sea-bathing in the summer, with the invigorating effects of a temporary residence at the sea-side. Sometimes, again, a good deal is gained by exchanging the sea-side for a hilly or mountainous situation; that is, in other words, a change of localities is highly important for the relief of this as well as of other scrofulous affections. Besides this, we should be careful to have these children kept perfectly warm; let them wear their flannel next the skin, and take a wholesome anti-tuberculous diet.

DISEASES OF THE HEART.

CHAPTER XVII.

GENERAL CONSIDERATIONS.

THE signs of the diseases of the heart are more easily learned and are almost as precise as those of the lungs. The structure of the heart is extremely simple, and its functions are very limited, although in the highest degree necessary to life. Each of its surfaces is also covered by a serous membrane which is the subject of much fewer lesions than the complex tissue of the lungs. The great simplicity of the structure of the heart has, however, its disadvantages for diagnosis; there is no expectoration from a mucous surface, and not the numerous combinations of sounds met with in the diseases of the lungs, which, although sometimes difficult to recognize, are, when once they are known, generally sufficient to point out with great accuracy the exact nature and seat of the lesion. So far as the signs of disease of the heart go, they are therefore very easy of recognition; but beyond a certain point they do not indicate the nature of the lesion with much precision, and the diagnosis is then approximative only.

The gradual researches of late pathologists have, however, removed much of this difficulty, and although we have not yet reached precision, it is more nearly attained than it formerly was; and many disorders, such as inflammation of the lining membrane, and some valvular diseases, are now much more easily recognized than they once were. This accuracy in diagnosis will probably be extended a little further, although we doubt whether it will attain absolute perfection, so as to enable us to recognize and to

precisely determine the slighter organic lesions. However, extreme nicety as to this point is not in most cases of great practical importance.

The discovery of ausculation has probably done still more for the study of the diseases of the heart than of the lungs—that is, they were before this time almost totally unknown, except the description of some of the pathological lesions. The symptoms of the different affections are so nearly allied, and so often obscured by those of various disorders of the lungs, that it was extremely difficult to distinguish them one from the other, or even in many cases to decide that any affection of the heart existed. The united influence of accurate observations, aided by physical exploration and of pathological anatomy, has removed these difficulties as much as the nature of the subject will admit; and now, as a necessary result, the progress of investigation has been directed to the causes which precede cardiac affections and to the numerous secondary disorders which result from them.

Thus the disease of the heart must be regarded as the only important pathological change, and the secondary affections may be lost sight of or regarded as mere symptoms of the cardiac lesion, not as separate disorders with their own set of independent symptoms. The congestions of the lungs and serous effusions into the chest are now, comparatively speaking, rarely mentioned in writings of late observers; even hydrothorax and asthma—when they are mere consequences of heart disease—now attract little attention. In fact, hydrothorax, though at one time considered as one of the gravest forms of disease, is now rarely mentioned. Not that it is more rare, but it is classed simply as an effect of other diseases, not as an independent affection.

The investigation as to the causes of heart disease has produced some unlooked-for results, and has shown very conclusively that in a large majority of cases, especially in young persons, it arises directly from inflammation. Even in the aged, inflammation is a secondary cause which adds very much to the slow alterations of nutrition which arise merely from advance in years. As the causes are now better known, the treatment of these affections has become more definite—that is, the early treatment, employed with perseverance during the commencing or inflammatory period,

before those fixed organic lesions are formed which are beyond the reach of art.

After this period our resources are more limited, and are strictly palliative, so far as the cardiac lesion itself is concerned, and our object is then rather to prevent the increase of the lesion and to relieve its effects upon other organs than to remove it. We regard organic alterations which have lasted for a long time, and have become, as it were, established, very nearly in the same light as original vices of conformation, from which they differ very little. The curative treatment is then applicable only to the reactive inflammatory stage, or to the early periods of the disease, in case it is not inflammatory at its commencement. Treatment may then be active and positive in its results.

Although in those stages in which the organic lesion is fixed and has become a mere peculiarity of nutrition, we cannot directly remove it, if we merely prevent its increase we may aid the natural powers of the system to recover the balance to which they are perpetually tending. In this way a considerable enlargement of the heart will sometimes gradually diminish, until the organ is, little by little, restored to its natural dimensions. These cures, however, must be limited to those cases in which the diseased part is enlarged, and the new superfluous portion of structure may then be absorbed; but when there is a destruction of an important part, or an entire perversion of its tissue, a cure can in no case be expected, and the treatment is then absolutely palliative.

Symptoms of diseases of the heart. These are to some extent common to all these affections, whether functional or organic, but they vary extremely in intesity, and are by no means directly proportioned to the severity or to the danger of the affection. The principal symptoms which occur in most diseases of the heart are irregular and disordered action of the organ, sometimes amounting to that degree of violence which is commonly called palpitation; painful or disagreeable sensations in the region of the heart; and impediments to the circulation, causing congestions of blood and effusions of serum. There is also frequently a flushed and somewhat swollen aspect of the countenance; often

a slight degree of cough, and a distressed condition of the patient.

Palpitation of the heart is more constant and troublesome to the patient in simple nervous disorder than in organic disease; in the latter case, especially in the more chronic varieties, it is usually provoked only by violent exercise, or by some sudden effort. In the acute inflammatory cases the symptom is often totally absent; but the palpitation which occurs in functional disorders is different in character, as well as in degree, from that which is met with in organic affections; especially in hypertrophy of the heart. Thus the palpitation in nervous affections is often slight, but at other times it is intense. It is not, however, the violent throbbing action which is produced in cases of organic disease. The term palpitation is therefore comparatively rarely used in speaking of the latter class of affections; on the contrary, it is almost confined to those cases of functional disorder in which it sometimes forms one of the most prominent symptoms.

Painful sensations in the chest are very variable; one of the most distressing is an acute pain felt near the left nipple, or at the extremity of the sternum: this pain, it is true, does not always coincide with any positive symptoms of cardiac disease, and in many cases it is plainly connected with a mere nervous disorder, or with dilatation, or with both these conditions combined. Sometimes this pain is intensely severe in cases of valvular disease, which interferes greatly with the functions of the heart. The pain is not accompanied with dyspnœa, as in angina pectoris, but it will sometimes extend across the chest or pass down the left arm.

Both palpitations and pain are as often connected with nervous disease as with organic lesion; but the case is very different with valvular disease and its effects. These are almost always more dependent upon organic alterations, or at least much more frequently and to a much greater degree, than upon functional derangement. They occur in muscular derangement of structure, as hypertrophy and dilatation, but are much more decided if the valves are at the same time diseased. As a general rule, they are more severe in proportion as the valves are narrowed, so as to prevent the free passage of the blood, forcing it, as it were,

backward, and thus producing congestions and anasarcous effusion, or hydrothorax. When the symptoms of heart disease have for a long time preceded the dropsy, they may be regarded as almost pathognomonic of a grave lesion, which is in these cases most frequently hypertrophy conjoined with valvular disease.

Irregularity and intermittence of the pulse attracted more notice before the discovery of auscultation than they do at present. For although this symptom is not without its value, and in reality often attends various heart diseases, it is necessarily uncertain, and sometimes occurs during the convalescence of acute diseases in which the heart is in nowise involved, while it is a congenital peculiarity in some individuals, lasting through a long life, but apt to terminate in decided heart disease. It is clearly not owing entirely to the obstruction, but also to the enfeebled action of the heart, which is no longer proportioned to the column of blood which it has to propel, so that the organ works in a hesitating, irregular manner. Now, this may arise from causes totally independent of actual disease of the heart, but it is more apt to occur in connection with heart disease than independently of it; and in other cases where no actual disorder is developed, the chances of future affections of the heart are certainly increased, provided the irregularity is a permanent symptom and not a mere consequence of the convalescence from an acute disease.

Causes of heart disease. The inflammations of the membranes of the heart not only constitute a frequent form of disorder, but they give rise to a large proportion of organic lesions. This is more especially the case with the inflammation of the internal membrane, for pericarditis has comparatively little influence in producing permanent derangement of structure. The causes of these inflammations resolve themselves into those which ordinarily produce the phlegmasiæ, and into the peculiar connection known to exist between them and rheumatic disease.

Thus the ordinary causes of serous inflammations, such as cold and exposure, sometimes give rise to, and may end in pericarditis, or these may afterwards become complicated with structural alterations of the heart. Acute articular rheumatism, however, is much more important, and perhaps it is even a more frequent cause of

disease of the heart than any other. It is certain that nearly if not quite every case of acute articular rheumatism, attended with much pain, is in fact complicated with heart inflammation, especially of the endocardium. In some cases there is no obvious inflammation at the time the patient is examined by the physician who looks merely for the signs of actual disease of the heart; but even in these cases, if we carefully inquire into the cause, we can generally trace back the symptoms to an acute attack of inflammation arising through the course of acute articular rheumatism.

Besides inflammation, there are, however, other causes of heart disease; the muscular tissue of the organ may increase in thickness from the constant activity into which it is thrown, and organic disease is in this way developed as a consequence of long-continued nervous excitement. Enlargement of the heart may also arise from a sudden injury inflicted upon it, as a violent strain or effort, or some other sudden propulsion of the blood toward the organ, which is strained beyond the power of complete recovery. Thus I have often seen cases of organic disease of the heart in which the patient clearly recollected the first symptoms of the disease arising from a sudden strain or violent effort. The gradual advance of age has also a tendency to produce a slow enlargement of the heart, and the formation of ossific deposits in the valves or its internal membranes; and in these cases there is at least no evidence of direct inflammatory action.

The causes of functional diseases of the heart are, of course, as various as those of all nervous disorders, and are sometimes the most opposite in their character; in general, the nervous disorders are apt to arise in cases of anæmia, or of deficient muscular power, or are directly dependent upon spinal irritation or chronic gastric disorder. This is almost always the case with the functional diseases of the heart which occur in young women, from suppression or other interruption of menstruation. These patients often complain of the most violent palpitation, which is not infrequently mistaken by unskillful physicians for actual disease of the heart. The same series of symptoms is sometimes observed in young men, particularly in those who have been accustomed to a sedentary life, to the excessive use of tobacco,

or to excess in study, or any other cause capable of producing partial disturbance of the heart.

Termination of heart disease. The acute inflammatory affections of the heart may terminate in recovery, and the patient be restored to entire health; but in many cases the disease gets well so far as the acute inflammatory attack is concerned, but an organic lesion remains. Chronic organic affections, as a general rule, do not terminate in recovery; they may end in death, or they may be prolonged without causing more than mere discomfort to the patient, and without shortening the natural duration of his life. The former termination is caused by the severity of the lesion, which may often be sufficient to seriously impede the circulation of the blood; or by the enfeebled state of the patient, and the thinness of the blood, which favor the dropsical effusions of the latter stages of these diseases. These aggravated cases vary in duration, but they generally either prove fatal of themselves, or they merely increase the severity and the danger of some intercurrent disease, so that death results from the combined influence of the chronic and the acute disease.

The structure and peculiar functions of the heart increase the mortality from its chronic diseases; they are rarely single, or, at least, do not long remain so, they tend not only to increase from the continued play and action of the heart, but one will produce another; hypertrophy will give rise to valvular disease and inflammation of the endocardium, while the converse is also true, and to a much greater degree. So, especially in young persons, endocarditis, even when it ends in recovery from the acute affection, often leaves behind it disease of the valves, which, again, by impeding the circulation of the blood, forces the heart to exert itself more strongly, and at last gives rise to disease of the muscular tissue. Functional diseases of the heart have in themselves little power in shortening life; but as they are at times causes of the organic affections, their indirect influence is sometimes very pernicious.

Influence of age and sex. Advanced age has a strong influence in favoring the development of heart disease, while the sex is also not without its influence. Men are much more exposed to the causes of inflammation than women, and therefore suffer more

from all the disorders which arise from it; they are therefore more liable to organic diseases of the heart. Nutrition is also more active in them, favoring of course the development of hypertrophy, and of other affections in which nutrition is in excess.

As regards the influence of age, it may be readily analyzed; cardiac diseases must be proportionately more numerous as we advance in life: First, because they are in many cases of slow growth, and form, as it were, insensibly, so that they only reach their full development after many years; second, because the changes of nutrition are in themselves more frequent in the old than in the young, as is proved by the invariable and natural increase of the heart as we advance in years, even if no absolute disease be developed.

Males are more liable to cardiac diseases than females, partly from their greater exposure to the causes of inflammation, and partly from the violent efforts to which the heart is subjected in many of the laborious occupations of the male sex. This, however, holds good only with the organic diseases of the heart; for the nervous functional disorders are vastly more frequent in women, especially in those in whom the nervous susceptible character is most developed.

Influence of hereditary predisposition. Diseases of the heart, like many other affections, are capable of transmission by inheritance. That is, the predisposition to rheumatism and gout is, as is well known, frequently inherited; and this entails with it a frequent development of an organic disease of the heart. Besides this, however, there are cases in which, from the similarity of constitution between parent and child, a great tendency to organic disease is developed. Sometimes this may occur in connection with endocarditis, which of course is apt to leave behind it an organic alteration. In other cases, however, we find merely a tendency to the formation of valvular disease, and of consecutive hypertrophy and dilatation, without the previous occurrence of inflammation.

Influence of occupations. Certain occupations are apt not only to develop disease of the heart, but to increase it when it is formed. Thus players upon wind-instruments, who of course exert the muscles of the chest strongly, in that way impede the motions of the lungs; the heart is afterwards interfered with, so

that hypertrophy of its substance is apt to ensue. Men engaged in laborious employments, which require great straining of the muscles of the chest, are also frequently the subjects of disease of the heart. Those who are exposed to great changes of temperature are often attacked with inflammations in the chest, or with rheumatism, in which endocarditis forms a prominent part.

Influence of habits of life. Persons who are disposed to those habits which excite powerfully the action of the heart are of course more exposed to its organic lesions. Thus violent gymnastic exercises occasionally produce them; in these cases the immediate cause seems to be a rupture of one of the chordæ tendineæ, from a violent strain given to the heart. Individuals who are subject to violent fits of anger sometimes suffer in the same way. Intemperance, by stimulating the heart powerfully, will occasionally give rise to disease; and the same remark applies to any other kind of excess, such as venereal indulgence or extreme fatigue.

General diagnosis and prognosis. Although accurate or special distinctions as to the precise seat of heart disease and its probable termination can only be made by studying carefully the physical conditions of this organ, and the precise part affected, there are certain general characters of heart disease which are well known in their application to the study of these affections.

Besides the special signs of organic diseases of the heart, they are generally known by some decided symptoms which indicate that some serious mischief has attacked the organ. These are orthopnœa, a feeling of weight and stricture in the præcordia, fullness of the cervical veins, and strong pulsation in the arteries of the neck, with great increase of dyspnœa in ascending a height, or a steep flight of stairs. Blueness or lividity of the lips is also an excellent sign. A thrilling pulse and œdematous effusions are often characteristic. The irregularity of the pulse and the violence of the palpitations are common to both nervous and organic affections; they are almost as frequent attendants upon the former as upon the latter class of diseases.

Pain confined to a limited spot near the apex of the heart is much more common in nervous affections; the same is true of a sensation of fluttering at the heart, of shortness of breath, proportionate merely to the palpitation, and differing from the vio-

lent dyspnœa of organic disease. The probability of nervous disorder is rendered much greater if the patient present other signs of a nervous temperament, especially if called into action by the usual exciting causes.

But the irregularity of the pulse in organic affections of the heart is in reality distinct from that which is caused by merely functional disorders. In the latter case there is often a decided intermission in the impulsion of the heart, causing the pulse at the wrist entirely to disappear; but there is not that excessively irregular action which occurs in organic disease. In the latter class of affections the heart sometimes intermits, or changes its pulsations in a regular way; at other times the confused movement of the heart is excessively variable; but it always has a different character from that which it exhibits in functional disorder.

The mode of origin of the disease is also important for diagnosis; if at first inflammatory, it is probably organic; or if the patient be stout and muscular, and of a family in which diseases of the heart are hereditary, the gouty and rheumatic diathesis is very strongly developed. On the other hand, both the original constitution of the patient and the previous existence of a disease capable of disordering the innervation, may render the existence of nervous affection probable. An affection of another organ, especially of the lungs, may act in the same way, and give rise to severe disease, which at times may appear to be organic, but will be quickly dissipated if the original disorder be removed. This is very frequently the case with affections of the lungs, especially if the left lung be much indurated, thus impeding the action of the heart, and conducting the sounds and impulsion both to the ear of the observer and throughout the chest.

The general *prognosis* of heart disease is commonly understood to be highly unfavorable; hence, in ordinary language, a person who is laboring under an affection of the heart is supposed to be incurably diseased. This is no doubt true as regards extreme disorganization of the valves, and of the internal membrane of the heart and aorta, as well as very decided hypertrophy and dilatation; but it is not true of acute inflammatory affections of the heart, or of the moderate degrees of hypertrophy. It is still

less applicable to the sympathetic nervous disorders which so frequently require medical aid, and often excite the greatest apprehension. Even in those forms of disease in which a strict cure is not expected, the symptoms may, after a time, cease to increase, and even positively decline, without apparently shortening life. Hence the prognosis really depends upon a special diagnosis, and is in fact included in it; and if the nature of the disease of the heart is once ascertained, and its rate of increase or diminution settled, the prognosis may be defined, provided no circumstances of a disturbing kind should arise.

I am always accustomed, when I find a patient laboring under organic disease of the heart, to assure him that there is no actual danger to life, if I believe that none exists. For it must be remembered that diseases of the heart, which are strictly called organic, are nevertheless exceedingly common; but for the most part do not very materially shorten the life of the patient. At the same time great apprehensions are entertained by most individuals of any disease of this organ; therefore, unless the physician is exceedingly careful to explain that there is no actual danger, considerable mischief may often arise from the knowledge which they obtain of their disease.

EXAMINATION OF THE HEART.

The heart requires to be examined under several different points of view. The most important of these are its position in the thorax and the relative situation of the parts of it; the size of the heart as ascertained by percussion; the impulsion; the sounds and their rhythm or succession; lastly, the mode in which the heart acts, whether in a regular or in a spasmodic, ill-defined manner. Besides these signs, which are strictly physical, we learn much as to the diseases of the heart from the sensations complained of at the præcordial region, the respiration and the impediments to it, the capillary and venous circulation, and lastly, the surrounding disorders of the whole body, which indirectly depend upon the cardiac disturbance.

Position of the heart. In general terms it may be stated that the heart is situated at the lower portion of the sternum, including nearly the whole breadth of this bone, and extending on the left

of it to a short distance within the nipple; in height the heart reaches from the intercostal space between the third and fourth ribs to the base of the thorax. It occupies, therefore, the anterior and lower portion of the left side of the thorax, in a definite extent, and this portion so occupied is called the præcordial region, or, in other words, the region of the heart. The exact situation of the heart, and the relative position of its different parts and valves, are readily seen by an examination of the recent subject.

I am indebted to the kindness of Dr. Wood for permission to use a wood-cut of the heart, published in the second volume of his *Practice of Medicine*, and copied from a drawing made under the direction of Dr. Pennock. It was originally published by Dr. Pennock in the *Medical Examiner* for 1840, and was copied in the second edition of the present work, published in the same year.

The size of the heart is a little exaggerated from the desire of Dr. Pennock to make it the principal portion of the wood-cut or lithograph, in which form it was originally published by him. But in the situation of the tubes of the heart and the relative position of the different parts, it is strictly correct. The accompanying description is from the text of Dr. Pennock:—

"The heart is represented with the pericardium removed, the lungs drawn backward by hooks, leaving its entire anterior surface exposed; the cartilages and ribs in front of it, indicated by dotted lines.

S, Outline of the sternum.
C, Clavicle.
1, 2, 3, 4, 5, 6, etc. The ribs.
1′, 2′, 3′, 4′, 5′, 6′, etc. The cartilages of the ribs.
4″, Right and left nipples.
a, Right ventricle.
b, Left ventricle.
c, Septum between the ventricles.
d, Right auricle.
e, Left auricle.
f, The aorta.
f′, Needle introduced through the middle of the sternum, perpendicular to its plane, opposite the cartilages of the third rib, passing into the aortic valves.
g, The pulmonary artery.
g′, Needle introduced between the second and third cartilages, half an inch to the left of the sternum, (perpendicular to the plane of the thorax,) passing into the valves of the pulmonary artery.
h, Vena cava decendens.
i, Line of direction of the mitral valve. The dotted portion is that part of it posterior to the right ventricle.
i′, Needle introduced perpendicular to the plane of the thorax, three inches from the left margin of the sternum, at the lower edge of the third rib, and passing into the mitral valve at its extreme left.
k, Line of the tricuspid valve.
m, *n*, Needles introduced perpendicular to the thorax, at points where the dullness of percussion of the heart ceases, and which, being projected, pass to the borders of that organ.
o, Trachea.
p, Apex of the heart.

"Upon reference to the drawing, it will be seen that the *valves of the aorta* lie beneath the middle of the sternum, opposite the lower edge of the cartilages of

the third ribs; that the *valves of the pulmonary artery* are more superficial, and are placed to the left, and about half an inch above. *The aorta*, from its origin, curves upward toward the right, extending between the cartilages of the second and third ribs slightly beyond the right margin of the sternum; at the lower margin of the second cartilage, the arch of the aorta commences and inclines to the left, crossing the pulmonary artery where it lies beneath the left second rib, and, ascending as high as the first rib, turns downward. The *pulmonary artery*, from its origin in contact with the sternum, commences at its left margin, where it is joined by the cartilage of the third rib, bulges at the interspace between the second and third cartilages close to the sternum, and dips beneath the aorta opposite the junction of the second cartilage and sternum.

"The right divisions of the heart, being most superficial, form the greater part of the anterior surface; the *right auricle* reaches from the cartilage of the third rib to that of the sixth, and between the third and fourth, where its breadth is the greatest, it extends laterally near *one inch and one-third* (*when full of blood**) to the right of the sternum. About one-third of the right ventricle lies beneath the sternum, the remaining two-thirds being to the left of that bone; the *septum* between the ventricles coincides with the osseous extremities of the third, fourth, and fifth ribs, and, on the fourth rib, is midway between the left margin of the sternum and nipple. A small part, say one-fourth of the left ventricle, presents anteriorly; and, when the lungs are separated, a portion of the left auricle is visible between the second and third left ribs, two inches from the left margin of the sternum. With the exception of these portions, the whole of the left ventricle and auricle lie posteriorly to the right ventricle; and the entire left divisions, with the exception of a small portion of the base connected with the semi-lunar valves of the aorta, lie on the left of the sternum.

"The heart being movable, the tricuspid and mitral valves necessarily change their relative position to the parietes of the thorax, with every change of posture of the body. When examined in the dead body, the normal situation of these valves is as follows: the *tricuspid valve* extends obliquely downward from a point in the middle of the sternum, immediately below the third rib, to the right edge of the sternum, at the lower margin of the cartilage of the fifth rib; the *mitral valve* commences beneath the lower margin of the left third rib, near the junction of its cartilage with its osseous extremity, (two and a half to three inches to the left of the sternum,) and runs slightly downward, terminating opposite the left margin of the sternum, where it is joined by the cartilage of the fourth rib.

"The apex of the heart, when an individual is standing erect, beats between the fifth and the sixth left ribs, about two inches below the nipple, and one inch on its sternal side. But, as the heart is attached only at its base by the large blood-vessels, 'the body of that organ is not fixed in relation to the walls of the chest, but hangs in a certain degree loose,' and liable to displacement by change of posture, and by the motions of the chest. Hence the pulsations of the apex are felt at different points of the chest, and the impulse is affected by the stage of the respiratory act. During full inspiration, the impulse of a healthy heart is scarcely perceptible; but upon expiration, and especially if, at the same time, the body be bent forward, the cardiac pulsations become very forcible."

*An alteration in the text suggested by Dr. Pennock.

Size of the heart. The size of the heart is known by two phenomena,—the abnormal prominence often formed in cases of enlargement of the heart at the cartilages of the fifth, sixth, and seventh ribs, and the dullness on percussion which may become greater or less than it should be in the healthy state of an individual of a given stature and embonpoint. By the size of the

heart, measured externally, we refer to the whole taken collectively; hence an enlargement of the muscular substance does not differ, as regards the physical signs of measurement, from the more external distention caused by effusions of pus or serum into the pericardium. When the increase in dimensions is very considerable, the chest is thrust forward, but the form of the prominence is different; when there is an effusion into the pericardium it is pyramidal, the apex of the pyramid at the upper portion; when it depends upon a real increase of the muscular structure, the projection is in general less marked, but more diffused, and forms an oval, the long diameter of which extends laterally, instead of vertically, as in the former case.

The more exact mode of estimating enlargement of the heart is, however, by percussion. This is readily enough practiced; but to render it of practical benefit, the observer should retain an accurate recollection of the average normal dimensions in an individual of the general health and condition of the patient. It is true that the general health may have a very decided effect upon the heart as well as upon the rest of the organs; for when the health is deranged the heart suffers with the rest of the organs, although the change is limited to a slight augmentation or diminution in size and thickness, corresponding with that of the muscular structure in general. The real advantages of percussion are much more decided when we desire to learn the condition of the heart and its state as an individual organ. To do this we must recollect that in the healthy individual the heart is not entirely overlapped by the lungs, but that a portion of its structure, which is chiefly composed of the anterior surface of the right ventricle, is in immediate contact with the parietes of the chest. This portion varies in extent, partly from changes in the condition of the heart and pericardium, partly from lesions of the lungs and pleura. Thus, without any actual change in the heart, the percussion at the præcordial region may be rendered very dull from induration of the lungs or pleuritic effusion, while emphysema may distend the lungs and render the sound preternaturally clear in the region of the heart. A little attention to the condition of the lungs will in general obviate the chances of error.

The heart itself, when diseased, often produces a decided change

in the results of percussion, which then depend upon the alterations of form. In the natural state, the extent of dullness does not exceed a space of about three inches in length, measured along the sternum, and about two and a half inches laterally; that is, the dullness extends to a short distance within the nipple; and about the middle of this space, just at the left margin of the sternum, it amounts in most persons almost to perfect flatness. The greatest dullness of sound extends over a breadth of one inch and a half to two inches; that is, over the space which the lung does not overlap; so that there are two sounds of percussion—one nearer the sternum which is almost flat, and the other more external, which is simply dull. The difference depends upon the percussion being made in the latter case over both the tissue of the lungs and the heart.

If the heart be enlarged, or if an effusion of liquid has taken place into the pericardium, the dullness is of course increased in proportion to the degree of enlargement or increase. When the dullness results from hypertrophy of the heart it is more rounded in its shape than when it depends upon pericardial effusion; in the latter case, the original shape of the serous sac is still preserved, and the space in which the dullness is most evident is pyramidal, the apex of the pyramid being toward the upper part of the chest.

The mathematical exactness of this mode of mensuration is readily ascertained by a process which was very carefully pursued by Dr. Pennock a few years since; that is, forcing long needles at the limits of the dullness, and examining the parts perforated by them after the body was opened.

Impulsion. The impulsion of the heart furnishes one of the least complicated sets of signs connected with this organ. It is produced, as is well known, by the contraction or systole of the heart, during which the point of the organ is quickly impelled against the ribs, striking near the cartilages of the fifth and sixth ribs, a little within and below the nipple. That is, this is the old explanation of it, which is still the one most generally received. The heart strikes against the wall of the chest from the quick jerking movement given to it during the act of contraction; the muscular fibres running in a spiral direction from the base to the

apex of each ventricle, so as by their combined contraction to tilt the apex forward against the anterior wall of the thorax. Within the last few years, however, a new opinion has been started as to the cause of the impulsion of the heart. Dr. Robinson, of Virginia, and M. Beau, of France, have both advocated this doctrine; they deduced their views from cases of new-born infants in whom the breast-bone was wanting. Dr. Robinson's case was published in the *American Journal of the Medical Sciences* for February, 1833, and Mr. Beau's case in the *Archives Générales* for April, 1851. Dr. Alfred Stillé, of Philadelphia, agrees in this opinion, which is that the impulse of the heart is synchronous with and produced by the diastole. On analyzing Dr. Corrigan's book, (of Dublin,) it was found that in all the cases of hypertrophy, the impulse at the apex was less than natural. It should be remembered that the true reason why, in cases of hypertrophy, the impulse at the apex is diminished, is not the fact of there being contraction or dilatation during the act of systole, but the fact of the mass of the heart being increased, so that the apex has scarcely room to extend itself. It may be looked upon, however, as in some degree corroborative of this opinion.

Dr. Wood, in his work on the *Practice of Medicine*, is also strongly disposed to admit the theory of the diastolic impulse. His views in this respect have been somewhat strengthened from the examinations which have been made in the case of Mr. Groux. Dr. Wood's opinions upon the subject are as follows: "It seems to me, after the most careful examination of much conflicting statement in reference to the heart's actions, that the theory which most plausibly explains the admitted facts is the following; though I by no means wish to be considered as holding it to be demonstrated. I had hoped for some positive conclusion from the various examinations which have been made in the case of Mr. Groux, whose congenital deficiency in the sternum has brought the actions of the right auricle within the scope of investigation; but the conflicting accounts have not tended to diminish the previous confusion. Let us commence with the heart in a state of repose. It is gradually filled, both auricles and ventricles, by the blood received from the veins. This is the *passive diastole*. Though filled, the heart is not distended. From this

state of repose it starts quickly into action. Simultaneously the auricles contract, and the ventricles are actively and energetically dilated. This is the *active ventricular diastole.* Instantaneously after its completion, without any interval of time, so that the two actions seem one, the ventricles contract, and send the blood over the body. Then both auricles and ventricles relax, and suffer the blood to enter them passively as before. At the moment of active dilatation the heart strikes against the walls of the chest, and immediately afterwards, synchronous with the systole of the ventricles, is the pulse in the carotids."* After a careful examination of Mr. Groux's case, Dr. Wood considers the above views of the succession of the heart's actions as to a great extent confirmed.

As to my own conviction, I must confess that I do not see yet sufficient evidence to thoroughly establish the doctrine of the diastolic impulse. It is, however, one of those points which are not practically of much moment; for the strong impulsion of the heart in cases of hypertrophy, it is obvious, must retain its value as a diagnostic sign, whether we admit that it is due to muscular contraction or muscular dilatation. The real difficulty in admitting the fact of the blow being given by dilatation, is simply this: The sharpness and strength of the impulsion are such as to make it very difficult for us to admit that it can be caused by mechanical dilatation, as we must do if we accept the diastolic theory; whereas the contraction would necessarily give rise to a forcible impulsion against the ribs.

In the healthy state of the heart the blow or impulse is given almost exclusively by the point of the heart; hence the sensation is sharp and decided, as would naturally be caused by the quick stroke of a small surface against the thoracic parietes. If the heart is thrown into violent action by quick exercise, or by nervous irritability, the impulsion is increased in force, but the surface upon which it falls is still very limited in extent. Should the bulk of the heart and the quantity of muscular tissue be increased, as in cases of hypertrophy, the momentum of the impulsion is much increased, but it is diffused over a much larger surface than in the normal condition of the organ, and the mass of the

* Treatise on the Practice of Medicine, vol. ii. p. 129. 1858.

heart is applied slowly against the chest, as it were point after point, so as to give it a heaving or waving motion, instead of a sharp, clear impulsion.

In low fevers, and other diseases in which the powers of life and strength of the patient are much diminished, the impulsion of the heart is decidedly lessened, and its force nearly destroyed. The diminished impulsion is then a good guide in therapeutics, and affords us one of the first indications for supporting treatment. The impulsion of the heart, it is evident, can only serve as a diagnostic sign, when the patient is still possessed of a moderate degree of strength; hence in cases in which the thickness of the muscular substance is really much increased, the force of the blow may be so much diminished by general exhaustion, that no stronger impulsion is made upon the parietes of the thorax than would result from a heart which is not at all enlarged.

Thus, in cases of hypertrophy of the heart, in which the augmentation in size is very great, the impulsion frequently becomes very moderate in the last days of life, especially in cases in which coagula are forming. The presence of these bodies in the heart always notably diminishes the impulsion; and the converse of this fact is also true, that if the impulsion be diminished, coagula are apt to form; and in cases where death occurs some days after the impulsion has been weakened, we sometimes find these coagula not only extremely small and tense, but small red striæ extending through them. These striæ I have been accustomed to ascribe to an attempt at the formation of vessels in the coagula.

The position of the impulse is, as has been stated, between the fifth and sixth ribs. When, however, the patient stands erect, the impulsion sinks nearly an inch below that point. In like manner its position may be shifted by a mere change of position of the patient from one side to the other, since the heart is a movable body, and must of course follow to a considerable extent the changes of position of the patient.

The impulsion of the heart is modified to a considerable degree also by the greater or less extent of the chest. Thus in individuals whose chests are very large, a heart of any given size will produce a much less degree of impulsion than in those whose chests are comparatively narrow.

In cases of children, the heart generally beats more strongly than in adults. We may account for this greater impulsion simply by the fact that either in a child or in an adult the heart is placed immediately below the ribs. Thus the impulsion of the heart must appear to be greater in the child, from the comparative thinness of the parietes of the chest.

The impulsion of the heart after cases of pericarditis, in which considerable adhesions have occurred, is to a certain degree modified. Whether we admit the systolic or the diastolic theory of the impulsion, it is evident that the point at which the heart strikes would be to some extent altered; so that the impulsion would be somewhat changed from its usual locality. But in cases of recent pericarditis attended with effusion, the impulsion is necessarily diminished; sometimes so completely destroyed that it can scarcely be felt.

Sounds. The sounds of the heart furnish us with one of the most important means of diagnosis, but require to be studied in the healthy state before becoming of practical use as signs of disease. The sounds of the heart are two in number, and are designated as first and second sound. The first occurs during the systole or contraction of the heart, and is synchronous with it; it is the longer of the two, and occupies about one-half the whole period of the heart's action, or, according to some authors, a little more than a third, and consequently the first sound may be heard during nearly one-half of the life of each individual. It is described as prolonged but dull, and it may be very readily learned by placing the ear over the heart, while the hand is applied to the pulse of the patient. The vibration of the artery and the sound are then perceived at the same time, although the sound of the contraction precedes a little the pulsation of the wrist, but the difference is so slight as to be scarcely perceptible.

Dr. Wood admits that the first sound is due to a combination of five causes: the blood rushing into the ventricles during the diastole; secondly, the impulsion; thirdly, the muscular contraction of the auricles and ventricles; fourthly, the closure of the mitral and tricuspid valves; and fifthly, the rushing of the blood through the orifices of the aorta and pulmonary artery.

I do not, however, regard all these causes as acting equally.

The principal ones may be set down as the muscular contraction, and the rushing of the blood through the orifices of the large arteries.

The cause of this sound is differently explained; probably it is not a single cause, but a combination of two or more which may in part account for any difference of opinion. The principal cause is certainly the muscular contraction of the heart, which is abundantly capable of producing a sound, as may be verified by experiments upon the hearts of animals. Take the heart of a calf or sheep from the body after sensation has been destroyed, but before the animal is quite dead, and by applying a stethoscope upon it, a sound will be distinctly heard which is identical with, although weaker than, the first sound of the heart; in this there is of course no cause for the sound but pure muscular contraction. But in the living body it is very probable that the sound is in part produced by the friction of the blood against the semilunar valves of both aorta and pulmonary artery; this cause, however, which is not so easy to demonstrate, is by no means so powerful as the muscular contraction.

The second sound is the proper valvular sound, and is shown by direct experiment to be caused by the quick contraction of the semilunar valves, especially of the aorta, which are much stronger than those of the pulmonary artery. If these valves be tied by passing a needle through them in the heart of an animal deprived of sensation, but still living, the second sound is immediately destroyed. The character of the sound is totally different from that of the first; it is very short and sharp, and is properly designated by the term clacking. It follows immediately after the first, and is synchronous with the diastole of the heart; when the semilunar valves are diseased, or prevented from acting by the excessive turgescence of the heart with blood, the second sound is weakened or destroyed. After the second sound a period of repose, occupying nearly one-fourth of the time of each complete action of the heart, succeeds, and is again followed by the first sound.

The sounds of the heart are, as may readily be seen, very regular in their succession and proportion, and when these are deranged a disturbance of the heart's action may be fairly inferred. Should the change be very decided and permanent, the cause must

nearly always be sought in the valves themselves; but if slight and temporary, it is often a mere muscular or functional disturbance not dependent upon organic disease.

The sounds of the heart may be altered in several ways; they may be changed in character, or merely diminished or increased in intensity. The alteration of the sounds may be limited to a slight harshness, or the natural tone may be totally changed; these characters, however, differ only in degree, and not in any really important respect.

The first sound is most frequently altered. When simply increased in loudness, it depends either upon a temporary condition of the heart—that is, a simple febrile movement or nervous action, in which case the sound will after a time subside to the natural state—or it arises from a hardening of the muscular structure of the heart, perhaps conjoined with slight obstruction of the semilunar valves. In the latter case the increased loudness, or, to use an equivalent expression, the roughness of the sound, may continue for a very long period.

If the roughness is increased, it passes into the *bellows* or *rasping* sound. The former of these is less marked than the latter; but a bellows sound may be defined, and it is generally described as a prolonged and purring sound, usually heard in the first sound of the heart, and therefore produced chiefly by muscular contraction, although it may also arise from alterations at the auriculo-ventricular valves, and then it occurs during the diastole of the heart. Like all sounds, it is much more easy to point out than to describe in words. As a short definition, the term bellows sound, which is given to it from its resembling the sound produced by blowing strongly a pair of bellows, is probably as good a description as any other. The bellows sound is often produced by simple nervous disorder of the heart, especially in those cases in which it is connected with anæmia or chlorosis, and it then is very loud and almost musical in its tone; and, far from being confined to the heart, it may be distinguished along the whole of the large arteries, especially the carotids and subclavian, by applying the stethoscope opposite to them. The pressure of the stethoscope has probably some influence in favoring the production of the sound at the carotids, but it is insufficient to account for it; so that we are obliged to ascribe

it to the peculiar motion impressed upon the thin and watery blood by the spasmodic action of the heart.

When the bellows sound depends either on a hypertrophied ventricle urging the blood very rapidly through a narrow or non-dilated semilunar valve, or driving it back through a dilated auriculo-ventricular opening, it is more persistent, more uniform, and is less musical, but more harsh than when it arises from a mere nervous disorder; the same character is found when the sound is heard during the diastole from regurgitation through the semilunar, or contraction of the auriculo-ventricular valves. Still it is in many cases difficult to distinguish between the bellows sound of mere functional disorder and that dependent upon organic disease, unless there are some other signs of a permanent lesion.

The bellows sound is occasionally as it were interrupted—that is, the sound seems broken up into two or three distinct parts. This peculiar alteration always depends upon considerable valvular disease, usually seated both at the semilunar and at the auriculo-ventricular valves. Of course it is in the one case direct, in the other, regurgitant; nevertheless the sound is much changed from what may be termed the natural and more common bellows murmur.

When the bellows murmur is caused simply by anemia, it has, as already mentioned, a more musical tone than if due to hypertrophy alone, or to this conjoined with valvular disease. This sound is in reality different in character from the proper bellows sound due to a lesion of the heart. Still it is very difficult to state in what this difference consists; but if strict attention be paid to the two sounds as they occur in different individuals, it will be readily understood that the bellows sound of functional disturbance, with or without anemia, is different from the intensely rough sound produced by organic alteration. This distinction between the two varieties of bellows sound is one that has struck me for a considerable time; and I have always been accustomed to demonstrate the difference to members of my class.

The *rasping* sound of the heart is much rougher than the bellows sound, and is tolerably well described by the term which designates it—resembling the sound of a rasp forced through soft wood more that any other sound. It never depends upon simple

functional disorder of the heart, but arises from some actual obstruction to the circulation of the blood seated at the orifices of the heart, and is therefore dependent upon changes in the valves. It may arise from acute as well as chronic disease; when the obstruction is acute, it is the result of endocarditis, and the thickening of the valves is partly caused by depositions of lymph and partly by thickening of the fibrous tissue, which forms the body of the valve. As the inflammation declines, the sound will gradually decrease, provided the morbid product has not become completely organized, in which case the rasping sound may be permanent. The sign is scarcely ever heard during the diastole of the heart, for it requires a considerable force in the current of blood, and the act of dilatation is rarely sufficient to produce this at the valvular orifices.

Such is not however the case when the aorta is much dilated, for the reflux of the blood is almost as powerful as its forward current, and the rasping is therefore double, like the forward and backward motion of a saw rather than of a rasp; hence it is then called the sawing (*bruit de scie*) instead of the rasping sound, and is one of the best diagnostic characters of aneurism of the aorta. The double movement and the accompanying sound are so peculiar that they can scarcely be mistaken for any other sign. The saw sound is heard also at times when the mitral or the tricuspid valve is much altered and altogether changed in form, so as to destroy its functions and convert the auriculo-ventricular opening into a rough passage for the blood.

Another sound closely connected with the heart, or rather the arterial system, is the humming-top sound, the *bruit de diable* of the French writers. This is distinctly heard in cases in which the blood has become very thin and watery, by placing the stethoscope over the carotid arteries. It is not properly connected with disease of the heart itself, but depends upon the thin and watery condition of the blood. The character of the sound is very exactly indicated by the name it has received.

The cause of this sound is the interruption to the passage of the blood, from the pressure exercised by the ear over the stethoscope, or some simple peculiarity in the course of the arteries.

It is very nearly analogous to the bellows sound produced by mere anemia, and arises in precisely the same manner.

Not only the sounds of the heart, but the rhythm or succession of them offer points of interest for diagnosis. It is very clear that as the sounds are, in a normal state, separated by well-marked divisions of time, a disorder of the rhythm or succession can only arise from some material obstruction to the action of the heart and the play of its valves, or from some decided functional disorder. The latter can produce only a moderate disturbance; such as irregularity in the relative rapidity of the pulsation, with occasional interruption of a single beat; or, at most, the heart may pulsate in an intermittent manner, a pulsation being from time to time absent, at intervals, which recur with some regularity.

The distinction between an irregular and an intermittent action of the heart is mainly the recurrence as to time of the latter symptom and the variableness of the former. An intermittent pulsation of the heart is congenital, or nearly so, with many individuals, lasting through a long life without much disorder of the general health; but if we watch these individuals narrowly we shall find that most of them at last suffer in some way from organic diseases of the heart. The temporary irregularity of the pulsation is much less important. Under many circumstances it is rather a favorable symptom, and occurs frequently at the termination of acute diseases, especially of those which have a definite duration, such as the exanthemata. There are other cases in which the irregularity is really a pathological symptom, but refers to another organ than the heart. This is the case with inflammations or other diseases of the brain, which, in many stages of their progress, are attended with irregularity of the pulse. There is, however, another set of cases in which the irregular action of the heart is a sign of disease of the organ itself, and if it be connected with other and more decided indications of inflammation, or more permanent organic alterations, it has its value. But as, in itself, irregularity is insignificant, the importance of the symptom in the study of heart disease is extremely slight.

There is another alteration of the rhythm very different from those just alluded to, and of much graver moment. In fact it is almost confined to organic valvular disease, and mainly to concre-

tions at the mitral valve: the proportion, as well as the peculiar character of the sounds, is then nearly destroyed, and we have a confused churning or purring sound, without any distinction of the first or second. So complete a destruction of the ordinary sounds of a healthy heart indicates the gravest lesions, and is generally connected both with dilatation of the cavities and disease of the valves.

The purring sensation (*fremissement cataire*) often felt as well as heard at the region of the heart, belongs almost as appropriately to this part of the subject as to any other. It is a sign of gravity, because the total change in both impulsion and sound which accompanies it can scarcely occur without both valvular and muscular disorder, and a free passage is opened for the blood, which is thus broken into many currents. The regular action of the heart is broken up, because there is no longer a uniform point of resistance nor of repose; for the stream of blood is no longer cut off by the valves. The term purring is quite characteristic of the sign, both as descriptive of the sensation of touch and of sound.

Another important sign of the diseases of the heart is derived from the mode of its contraction. Instead of the natural contraction we may find it to be quick, jerking, and spasmodic, or it may be confused and indistinct. These are peculiarities very difficult to describe, and only to be appreciated by one who has been long practiced in the observation of the healthy heart. After a knowledge of the natural contraction is acquired, any deviation from it becomes very apparent. When the internal membrane of the heart is inflamed, the contractions lose their sharpness and distinctness, and succeed each other in a confused jerking manner: the sign is much the same in cases in which the valves are much diseased, especially when there is great dilatation of the auriculo-ventricular openings. Indeed, any decided organic lesion of the heart modifies the natural action, and even functional disturbance of it to a certain extent produces the same effect, but in a less degree, and for a less period of time.

The next part of our subject leads us naturally to the study of the individual diseases of the heart.

CHAPTER XVIII.

PERICARDITIS—ANATOMICAL CHARACTERS—PHYSICAL SIGNS—GENERAL SYMPTOMS—DIAGNOSIS—PROGNOSIS—CAUSES—TREATMENT.

THE frequency of pericarditis has been known only of late years. It was formerly supposed that it was a very rare disease, and attended with symptoms of great severity, terminating in most instances fatally. Later investigations have, however, proved that such is not the case, but that pericarditis is an extremely frequent disorder, not much more severe in many instances than pleurisy, and very often not recognizable by any rational symptoms. The most important of these researches were those of Dr. Louis, published in the year 1826. He then thought that the only conclusive evidence of previous pericarditis was adhesions between the two surfaces of the serous membrane; but it is now ascertained that in many instances of slight pericarditis there is merely a deposit of white opake lymph in patches upon the surface of the heart, and not an actual adhesion. The observations of Dr. Louis did not, therefore, in all probability, include more than a very small proportion of cured cases of the disease.

At first, the only evidence that pericarditis was curable depended upon the traces left behind it, and discovered in the bodies of patients dead of other diseases; but as the symptoms of pericarditis became better known, it was recognized in most cases during life, and could be traced throughout its whole course unto complete recovery. As before attention was directed to the subject it was believed that it was always, or nearly always, attended with severe and dangerous symptoms, it is now known that, in the great majority of cases, the symptoms are but slight, and that not unfrequently the disease cannot be recognized; or,

in other words, it is latent, except through the aid of the physical signs. There are even some slight cases in which the latter are by no means conclusive, so that very few disorders are as often overlooked as pericarditis. It is, therefore, the more necessary to pay close attention to the signs which can be detected, otherwise the slighter forms of the disease may pass almost insensibly into more severe and dangerous varieties.

From the most careful attention I have been able to pay to this subject, I do not believe that pericarditis is much more fatal than pleurisy. Like this disease, it is very seldom sufficiently severe to destroy life of itself. None of the serous membranes of the chest can be looked upon as vital organs; they are mere investments to the more important viscera, intended to give them facility of motion, and they do not produce in most cases any notable danger to life when they are inflamed. Still, inflammation of them is always capable of causing much inconvenience and suffering, although its direct effect in shortening the duration of life is but slight. The cases in which pericarditis is found after death are almost always complicated with other diseases, so that its real agency in destroying life is comparatively subordinate.

Anatomical lesions. The lesions of pericarditis are similar to those of other serous membranes, with slight differences depending upon the peculiar structure and situation of the membrane. At first the natural serous secretion is but little altered, and is even less abundant than usual, so that the surface of the serous membrane becomes preternaturally dry. It gives to the finger a sensation as if the serous membranes were sprinkled over with grains of sand. Almost at the same time, or soon after the inflammation has begun, a slight formation of lymph takes place, at first in the form of little points or dots scattered over the surface of the membrane, which gradually become more and more numerous, until they unite in one uniform membrane, and cover the whole surface of the pericardium. The lymph is in this stage soft, not much thicker than wrapping-paper; when it becomes more abundant certain portions sink in the form of shreds to the lower part of the serous liquid, and the coating which remains attached to the heart becomes roughened, and assumes a honey-combed ap-

pearance, which depends upon the continual motion of the heart, and the drawing asunder of the two coats of false membrane.

Simultaneously with the secretion of lymph, a certain quantity of serum is effused. The aspect of this liquid is sometimes transparent; it is generally, however, of a well-marked citron tint, and sometimes is even reddish, from the admixture of blood-globules thrown out in consequence of the inflammation. The quantity of this serum is very variable; sometimes it is only an ounce or two, in other cases it amounts to a pint, or even more. Usually, in bad cases of pericarditis, it is between six or eight ounces. The cause of the greater or less quantity of the serum is not so much the violence of the inflammation, as the greater or less strength of constitution of the patient, and his consequently greater or less ability to secrete lymph.

In some cases of pericarditis there is scarcely a perceptible quantity of serum, the secretion consisting exclusively of lymph. These are cases which have received the name of dry pericarditis, and are precisely similar in anatomical characters to dry pleurisy. The injection of the serous covering of the heart is very similar to that which occurs in ordinary cases of serous inflammation, but the disease differs in its symptoms and its less duration from ordinary pericarditis.

Sometimes there is a small admixture of pus with the lymph, in the same manner as sometimes occurs in the early stages of pleurisy: this admixture, however, is not frequent, except to a very slight degree. At least I am accustomed generally to ascribe the cases in which the color of the liquid is of an intense purulent yellow, to the admixture of a small quantity of pus with the serum.

After the process of cure commences the serum is first absorbed, as in other cases of inflammation of serous membranes, and the false membranes become consolidated into newly-formed tissue. This assumes the appearance of ordinary serous membrane when it forms partial adhesions between these two surfaces of the membranes; of cellular tissue when the adhesion is so extensive as to block up the whole or a large part of the cavity, and prevent the passage of serum between the two opposing portions of the pericardium; of opake white patches of firmer tissue,

sometimes semi-cartilaginous, which form a close adhesion to the membrane, but may still be removed from it by strongly scraping with a knife: or lastly, of a simple opacity of the membrane depending, not generally upon a deposit on its surface, but on the effusion of new matter in its substance or beneath its adherent surface.

The process of absorption, after the more acute periods of the inflammation are passed, is generally more slow than that of effusion; but if there is little lymph, and a large proportion of serum, it sometimes takes place with great rapidity. If the quantity of effused liquid continue to increase, the disease generally terminates fatally, from the excessive dyspnœa and the impediment to the action of the heart. If the disease pass into the chronic form, the condition of the liquid is changed, and becomes gradually purulent, as in other cases of serous inflammations.

The injection of the vessels of the pericardium is similar to that of other serous membranes. At first it is confined to a few dots and aborizations in the membrane, but gradually increases, until nearly the whole surface is of a bright arterial redness, covered with a fine vascular net-work. If these vessels be minutely examined, they will be found to be situated in that part of the serous membrane which adheres to the cellular tissue; the serous surface is still smooth, and nearly transparent; in the same stage the lymph may be removed from the surface, and leave it transparent until adhesions begin to form; then the transparency and smoothness of the surface are gradually destroyed; so that blood, and afterwards vessels, are formed in the lymph, and inosculate with those of the membrane. It is evident, therefore, that the question whether the serous membrane is really thickened or not, depends merely upon the application of the term membrane; if it be confined to the external layer, it is very certain that it is not rendered opake until a late period of the disease; but there is an actual thickening of the internal or adherent layer.

The inflammation of the pericardium is very rarely of a tuberculous nature; this complication is, however, occasionally met with, and the anatomical characters are then quite similar to those of tuberculous pleurisy.

Symptoms. Pericarditis, like other pectoral affections, is recog-

nized in part by local and physical, and in part by general symptoms. The physical signs of pericarditis are quite as conclusive as those of any other pectoral affection when well developed; but when the disease is slight, and attended with but little serous effusion, they are often insufficient for accurate diagnosis. These signs depend upon the physical properties of the effused liquid, and the changes in the action of the heart proper. As the physical lesions are greatest in those cases in which the liquid is most abundant, the signs are then the most decided.

They are as follows: 1. *Signs of conformation.* The liquid, if in a large quantity, will of course distend the walls of the chest, and give rise to a fullness in the præcordial region. This is rather pyramidal than oval in shape, and extends from the diaphragm, or base of the chest, to the third rib, if the quantity of liquid amount to a pint or more; laterally the fullness extends to the nipple, or sometimes it may even pass a short distance beyond it. The rise is very gradual; hence it requires careful inspection, in many cases, to discover it.

Of course in women or even in fat men, the slight bulging of the chest is scarcely perceptible in pericarditis. In thin persons it is, however, always very marked, when the quantity of serum exceeds a few ounces.

2. *Percussion.* The evidence furnished by this mode of investigation is much more conclusive. If there be a decided prominence in the præcordial region, the percussion is of course flat to the same extent; for the prominence depends upon an effusion of liquid between the walls of the chest and the heart, thus forcing the lung aside, and destroying the healthy resonance of the chest. Percussion is, therefore, of immense value in those cases in which the effusion is large; but when there is little or no liquid, and the effusion consists almost entirely of lymph, there is comparatively little dullness,—at least no more than would be caused by a heart moderately hypertrophied.

Still, even in these cases, there is a difference in the form of the dullness between pericarditis and hypertrophy of the heart. When the muscular tissue of the heart is simply thickened, the dullness extends more laterally, and assumes a nearly rounded form. In pericarditis it is more pyramidal, the apex of the pyra-

mid being of course placed above. It also encroaches more on the right side of the chest; for in hypertrophy of the heart the increase of muscular substance is of course mainly in the cavities of the left side.

3. *Auscultation.* The necessary effect of a large effusion of liquid is to compress the heart and impede the freedom of the action; the organ is also removed to a greater distance from the walls of the chest, which, of course, makes the sound less distinct to the observer. Hence the natural effect of pericarditis is to render the sounds of the heart distant and feeble; in some cases to so great an extent that they can scarcely be distinguished. The sounds are most feeble in those cases in which the effusion is greatest, for if there be lymph and no serum, the diminution of the sounds is much less perceptible; and, in some cases, the first becomes really louder, but more or less altered, and of a bellows or rasping character. The bellows sound is, however, rarely produced by pure pericarditis, but depends, in most cases, upon the inflammation of the internal membrane, though not in all, for any great disturbance of the action of the heart may give rise to a bellows sound. The rasping sound is not found in pure pericarditis. The sounds of the heart gradually resume their ordinary distinctness as the inflammation abates and the effusion is absorbed.

In certain stages of pericarditis another sound occurs which is similar to that heard in pleurisy under the same circumstances; it is a slight friction sound, compared by some writers to that produced by the bending of two pieces of new and rather stiff leather. This description is as exact as any other, and if attention be paid to the termination of the systole, and the commencement of the diastole of the heart, it will be readily detected when present. At first it requires some attention to distinguish the creaking from the proper cardiac sounds, for it is not very loud in many instances. In other cases it is so distinct as not only to be readily heard, but even to communicate to the hand a decided quivering sensation. The sound may, of course, occur either in those stages of pericarditis in which the liquid is almost absorbed, or in the early stages of the disease, when little or no serous effusion has taken place.

This friction sound is probably produced in every case of pericarditis as regularly as that of the pleura in cases of pleurisy. It is true that it is not always clearly made out; it requires more attention, when it is but slightly marked, to be heard. Besides, as it is synchronous, not with the dilatation of the substance of the chest, but with the motion of the heart, the attention is not always directed to it as strongly as it should be. The spot at which it is heard is generally a little above the apex of the organ, but not invariably so; sometimes it is heard above, near the points of origin of the large vessels, at other times nearer to the apex of the heart. The cause of this variety in situation seems to be really the greater or less tenacity of the effused lymph at the points at which it is produced.

The friction sound met with at the very beginning of the pericarditis is extremely slight, as it arises merely from the deposit of little grains of lymph, which interfere slightly with the movement of the heart. But toward the decline of the disease, the sound is always more marked, and sometimes lasts for a very long period after the patient has entirely recovered. I have a number of times heard it many months after the patient had got well, and in one case I even detected this sound more than a year after an attack of pericarditis.

The friction sound is always to a certain degree double, and accompanies both sounds of the heart, being rather louder with the first than with the second; it is produced by the contraction and dilatation of the heart. This is precisely similar to what takes place in cases of pleurisy.

In cases of pericarditis with but little effusion, some of the physical signs are absent. The sounds of the heart are not much, if at all, more feeble than in health; although they are in general somewhat altered, and may be more or less combined with the bellows sound. The friction sound, however, is in these cases usually quite distinct, and furnishes us with one of the best diagnostic signs, rendering it comparatively easy to recognize even the slighter cases of pericarditis.

The local symptoms of pericarditis, other than the physical signs, are extremely irregular; in many cases the pain, which is often so severe in inflammations of the serous membranes, is

totally absent—hence pericarditis has been so frequently overlooked; or the pain may be limited to a very slight feeling of uneasiness, not causing any decided suffering. In a few cases the pain is much more severe, and may become extremely acute, oppressing the action of the heart, and preventing the free motion of the organ; these cases are the severe ones which at one time passed as the type of pericarditis.

The dyspnœa is extremely variable, but, as a general rule, is much more moderate in simple cases than in those which are complicated with inflammation of the internal membrane of the heart. As the symptom is not at all limited to pericarditis it is of little value in diagnosis, and does not often reach an intense degree except in those cases in which the inflammation is not only extended to both membranes of the heart, but includes the lungs or their membranes.

Cough is a symptom which is rarely absent in the inflammations of the serous membranes of the chest, but it is very slight and short in all of them, and especially in pericarditis, which, of course, involves the lungs only indirectly, and has comparatively little action on the bronchial mucous membrane.

The local signs of pericarditis are, therefore, remarkable for their great irregularity and total want of proportion with the progress of the inflammation or its extent. In this respect, pericarditis resembles other serous inflammations, and is even yet more uncertain in its symptoms.

The general symptoms are still more obscure; indeed, no diagnosis can be made from them. In all serous inflammations they are not proportioned to the severity of the local disease; and in pericarditis, the connection of the organ affected with the pulse destroys the value of the symptoms dependent upon it. Obscure and doubtful as it is, the pulse is the only one of the general symptoms which furnishes a guide in pericarditis; the thirst, the loss of appetite, and cerebral symptoms are completely secondary, and often totally absent; when present, they depend merely on the degree of fever, and are strictly proportioned to it. They may, therefore, be properly passed over without special notice, unless in a monograph, which must contain all the symptoms met with in the course of the disease.

The circulation may be perfectly regular, and present nothing abnormal, both in the arteries and capillary vessels. In a number of cases of pericarditis, especially if of a subacute or scrofulous kind, the pulse does not rise above eighty in the minute, and is soft and regular, while the capillary circulation is equable, and the face scarcely flushed. In other cases of pericarditis, a different effect is produced upon the circulation, the pulse is extremely irregular and very small; these cases are, it is true, generally complicated with endocarditis; but this connection is not invariable, for pericarditis itself will sometimes so much impede the action of the heart that the pulse is scarcely felt. Between these opposite conditions of the pulse there are many intermediate degrees, and often slight irregularity; but as a general rule, the pulse is smaller than in most other inflammatory diseases, because there is a direct impression made upon the muscular action of the heart. The capillary circulation is at times much loaded, and the face extremely flushed, or even livid, as in other cases in which the circulation through the heart and lungs is much impeded. There is, therefore, nothing peculiar to pericarditis in this condition of things; but, on the contrary, as the variety of symptoms is great, and as the difference in their intensity is such that the disorder varies from a really trifling and latent affection to one attended with the greatest oppression and the most intense anguish, we are obliged, as has been already stated, to look to the physical signs as the only certain means of diagnosis. The other symptoms serve to confirm or to limit the diagnosis, but cannot form the foundation for it.

Diagnosis. The diagnosis of pericarditis is in general easy, if we have an opportunity of watching the disease throughout its course. It must necessarily be based mainly upon the physical signs; but these furnish us in most cases with conclusive evidence of the existence of the disease. The cases which it is most difficult to distinguish are certainly those in which inflammation of the left pleura occurs simultaneously with the pericarditis; for here the friction sound produced in the pleura may absorb the attention of the physician. In these cases it would be well to attend to the different characters of sound laid down by Dr. Stokes. He states that five friction sounds are heard simultaneously; two produced

by the heart, two by the lung, and one from the impulse of the heart against the pleura. I admit that these sounds are sometimes heard; but there are cases of pleurisy on the left side in which the pleuritic sounds of friction are especially produced over the heart. They then, to a great degree, conceal and mask the proper heart sounds; so that from this cause a real difficulty sometimes arises. But in most cases of this combination, the diagnosis between the pericarditis and the accompanying pleurisy may be made by careful auscultation.

Prognosis. The prognosis of simple pericarditis is in general favorable, a very small proportion of cases proving fatal. The exact number cannot be ascertained with accuracy, because so many of the slighter varieties pass unnoticed. Taking the severe and mild forms together, five per cent. would probably be a near approach to an accurate estimate of the fatal cases. The cases which prove fatal are generally pericarditis complicated with endocarditis, or sometimes with severe pleurisy or pneumonia. In these cases, the fatal termination, it is manifest, is rather to be ascribed to the complication than to the proper disease.

The after effects of pericarditis are not in general productive of much ultimate mischief if the disease is not complicated with endocarditis. In this case the real mischief depends upon the latter affection, which leaves behind incurable affections of the valves of the heart. If the pericardium be but slightly inflamed, no possible mischief can result from the slight deposit of lymph, causing merely an opacity upon its surface; but if the inflammation be extensive enough to leave behind considerable adhesions, they will, to some extent, impede the action of the heart, and thus may favor the formation of organic muscular disease.

The *causes* of the disorder are either those of ordinary serous inflammations of the chest, or acute articular rheumatism. The latter disease is the more frequent cause of those severe varieties in which there is much pain and other obvious symptoms; but the slighter cases are generally produced by exposure to cold and damp. The renewal of the causes of the disease is apt to produce a repetition of the attacks, until at last the inflammation becomes complicated with endocarditis, or organic alteration of the heart.

Treatment. The treatment of pericarditis is simple, more so perhaps than that of pleurisy, as the extent of surface involved is less considerable, and the membrane is removed to a very little distance from the surface, which renders the action of local depletion much more certain. The treatment in severe cases, which are generally complicated with endocarditis, must be extremely active—that is, a large and full blood-letting should be followed by a free cupping or leeching within an hour or two, provided the patient has reacted. If the patient has been in previous good or tolerable health, and the circulation of the skin is active, I prefer cups; under other circumstances leeching is necessarily prescribed in preference. The uneasiness is generally relieved, though rarely removed, by these first applications. If the pericarditis predominates, it will then be better to continue local bleeding by repeated applications of cups instead of venesection; but if the inflammation of the internal membrane plays a prominent part, repeated venesection is often necessary in the early periods. In no disease can we trace the powerful and immediate effects of cupping so clearly as in pericarditis; the effusion often diminishes immediately, and the action of the heart becomes fuller and more equable. The most obvious benefit does not appear, however, in those cases in which there is much effusion, but rather in the early or dry stages of pericarditis, when there is merely intense vascular excitement, and some secretion of lymph, but very little serum.

If the effusion be large, blisters are a much more effectual means of removing it than cups or any other vascular depletion. They exert the same power in pericarditis as in other cases of serous effusions, and tend, at the same time, to check the further progress of the inflammation, and favor the absorption of the effused fluid. If the disease becomes chronic, they may be reapplied at short intervals.

The internal medicines are generally less potent than those applied externally. They differ little from those used in other serous inflammations; the most powerful are, of course, the preparations of mercury, pushed so as to produce a rapid ptyalism. In my own practice I have preferred the combination of calomel, ipecacuanha, and opium, to any other form. The ipecacuanha

and opium are soothing, and tend to give temporary relief to the patient, while they do not interfere with the action of the mercury, which is the strictly curative agent. The usual dose is half a grain to a grain of calomel, and the same quantity of ipecacuanha, with a quarter of a grain of opium, every two hours. If the disease is not violent, the mercury need not be given so frequently. With the commencement of ptyalism, or just before it, there is usually a decided diminution of the symptoms; and often a rapid absorption of the effused liquid takes place.

Digitalis has long been used in the treatment of pericarditis, and with considerable advantage in the chronic forms of the disease, when there is much liquid of a thin serous character. In cases complicated with endocarditis the digitalis also acts well; but it is so difficult to produce a full and rapid action of the remedy that it is not safe to trust to it except as an aid to more efficient means. Tartarized antimony is also of benefit; but as its action is less certain than that of mercury, it should be used only in connection with it to favor its action, or to diminish the activity of the circulation before the mercury has had time to produce a full impression. Like the digitalis, it is most fitted for those cases in which the internal membrane of the heart is involved. Besides, it is always of decided disadvantage to produce vomiting; we must therefore take care to avoid this if we wish to give tartar emetic. It should not be given in larger doses than the eighth or the sixth of a grain every few hours.

These measures will generally succeed in violent cases of pericarditis; the slighter ones are relieved by the same treatment, and indeed terminate favorably under almost any circumstances.

The hygienic measures necessary in pericarditis are simple enough. Entire rest, abstinence from all stimulants, and almost from food, with a careful avoidance of mental emotions, are necessary in the acute cases. Even in the less violent, or more chronic varieties, the patients should carefully avoid such excitants as act especially upon the heart.

The treatment of chronic pericarditis differs but little from that of the acute. General blood-letting is, however, inadmissible, except in a few rare cases in which the excitement rises nearly to acute inflammation. Repeated cupping, blisters, and occasionally

other counter-irritants, are more useful than any other remedies. The continued but careful administration of digitalis is, in this case, of more benefit than when the disease is more acute. Lastly, mercurials in small doses will generally complete the cure.

The patient should be kept in an equable and rather warm temperature during the whole progress of the disease, to prevent anything like a recurrence of chills, which are often developed at the beginning of pericarditis. Besides, he should be warmly clothed, and ought not to leave his bed during the more severe period of the disorder. When the disease is about terminating, benefit is often derived from placing over the pericardium an ordinary Burgundy pitch plaster or a diluted warming plaster. These applications protect the skin against ordinary changes of temperature, and at the same time keep up a moderate amount of perspiration from the part.

CHAPTER XIX.

ENDOCARDITIS—ANATOMICAL CHARACTERS—SYMPTOMS—CAUSES—DIAGNOSIS—TREATMENT.

It is now perfectly well known that inflammation of the lining membrane of the heart gives rise to the greater number of diseases of the valves, and indirectly to alterations of the muscular structure. This fact has been proved in two ways: first, because a large number of cases of inflammation of the heart, which have ended in partial recovery, have given rise to valvular diseases in individuals who were before in the enjoyment of good health; secondly, because the traces of previous inflammation can be detected in most instances upon the examination, after death, of the bodies of those who have died with various valvular diseases, or with hypertrophy of the heart. The experience of every one who has seen much of these diseases verifies this conclusion; and we are therefore not only obliged to modify our opinions as to the treatment of these affections, but to study the phenomena of inflammation of the lining membrane with more interest than we should perhaps feel if its consequences did not extend farther than the immediate attack.

Anatomical characters. The anatomical characters of inflammation of the lining membrane—that is, endocarditis, are less distinct than they otherwise would be, because the products of the inflammation are not contained in a closed sac which retains them until their absorption. On the contrary, they are exposed to the washing of the current of the blood, which removes all those depositions which are not either intimately combined with the lining membrane of the heart, or formed beneath it. A part of the lymph adheres to the valve, and forms afterwards concretions upon its surface; another part is deposited on its thickness, and,

of course, may also produce permanent changes of structure. Sometimes these products of inflammation disappear with the removal of the cause which has produced them. Hence, we can have no collection of pus or serum, although we find some traces of the more solid portion of the lymph, and may discover other alterations of structure which result from inflammation, such as thickening or ulceration.

When inflammation begins, the membrane is highly injected like other serous tissues, the injection depending upon minute vessels and extravasated points of blood immediately beneath the surface of the membrane; that is, upon its adherent portion. A cloudiness of the membrane is soon perceptible, and it gradually becomes of a dull whitish tint throughout, with fine red injections, from a thin coating of fine lymph, which adheres so completely to the membrane as to become almost a part of its substance. Upon the valves we often find the lymph thrown out in a different form; in that of granulations or vegetations of a cauliflower form, which were at one time absurdly enough supposed to depend upon a syphilitic virus; these are the depositions which are most apt to become organized, and to form different kinds of valvular disease. In the cavities of the heart, the lymph is nearly always thrown out in the form of delicate laminæ, which give a whitish appearance to the membrane after the cure of the endocarditis.

Ulceration is sometimes met with, although it is not of usual occurrence, at the valves, or near their base upon the muscular substance of the heart, and sometimes takes place at other portions of the lining membrane. The ulcer appears to arise from a small abscess formed beneath the lining membrane, which gives way after a time, leaving an opening with irregular everted edges of an intensely red color. When these ulcers take place at the valves, they often give rise to an irregular vegetation, partly consisting of lymph, partly of calcareous matter. I have sometimes seen them projecting toward the interior of the heart to the length of half an inch or more. One or even two of the divisions of the semilunar valves are subject to another alteration, which in some cases seems to be connected with inflammation; they become thin, give way to the pressure of the blood, and their fibers separate.

The part of the endocardium which is most frequently attacked with inflammation, is always that covering the valves and immediately contiguous to them. In many cases of endocarditis, no traces of inflammation can be traced except at the valves, or in the part of the membrane immediately at their base, the other portions remaining nearly natural in appearance. In severe cases of the chronic form, the whole of the membrane may be inflamed, although the largest deposits of lymph and the greatest injection are usually confined to the neighborhood of the tubes.

Endocarditis is a disease which is almost confined to the cavities of the left side; that is, it is an inflammation which is mainly connected with the presence of arterial blood. The endocardium itself is so similar on both sides of the heart that the difference in frequency of inflammation cannot be accounted for by any peculiarity of structure on the left side. We are obliged, therefore, to account for it by the different quantities of arterial and serous blood. The same difference exists to a great degree throughout the arterial and venous systems. The left ventricle is more frequently attacked than the auricle on the same side, but both cavities usually participate to some degree in the inflammation.

The muscular structure of the heart, in all probability, suffers more or less during a severe attack of endocarditis; but it is difficult to demonstrate what the lesion is, for the disease is evidently of a rheumatic character, and does not tend to the formation of pus. The heart, however, evidently increases in consistence, and becomes harder than usual immediately after the inflammation of the membrane has ended.

The heart very often receives a larger quantity of blood than usual, during an attack of endocarditis, and thus is immediately disposed to become thickened. After recovery has taken place, if the attack has been a severe one, this thickening almost always passes into permanent hypertrophy; and although this latter lesion is produced to a certain degree by the permanent disease of the valves, yet I often look upon it as having its foundation laid during the attack of acute endocarditis, which of course gives rise to a determination of blood to the part, as well as immediately modifies the muscular contraction.

The consequences which often result from endocarditis are,

however, extremely important. When in the course of the inflammation the valves are greatly affected, they often continue altered in form after it has subsided. These alterations arise, in part, from the deposition of lymph upon the internal membrane; after the inflammation has passed off, the valves remain much thickened, because the lymph adheres closely to the membrane and becomes almost incorporated with it, causing permanent thickening. The valves are also altered from ulcerations, which, of course, by removing a part of the tissue give rise to permanent changes, and render the valve less in size than it was originally. In other cases the alterations of form depend upon a corrugation or shrinking of the tissue, which necessarily becomes a permanent lesion, continuing long after the acute inflammation has passed away.

The secondary lesions, thickening of the valves and lining membrane, are not always evident after cases of endocarditis; they occur when the inflammation has reached a certain degree of severity, and should be looked upon as of precisely the same character as the adhesions and patches of lymph which remain after pleurisy or pericarditis. But when the endocarditis has been moderate, it often gets well without leaving a trace behind it. At other times there is merely a light milky color of the membrane, differing from its natural transparency; this color is not unfrequently found in dead bodies, and may, in most cases, be regarded as a trace of a previous attack of endocarditis.

Physical signs. The physical signs of endocarditis are in some cases extremely well marked. In the most severe forms of the disease the heart is distended with blood, which forms coagula, often becoming completely organized before death. Hence the sound of percussion becomes duller than usual, but of course it can never be so dull as in those cases of pericarditis in which there is a large serous effusion.

The form of the space in which dullness exists is also different from that of pericarditis. Thus it is oval, not unlike that met with in cases of hypertrophy, and, of course, very unlike the triangular form of pericarditis. This arises partly from the distention of the heart with coagula, as already mentioned, and partly from a congestion of the muscular tissue. A careful per-

cussion will, in every case except where the patient is very fat, enable us to recognize this sign in all cases of endocarditis; it is more marked, however, in cases of children than in adults, as the muscular fibers of the heart are in them more easily distended from internal pressure, and, of course, more readily allow of an increase of its dimensions.

The impulsion of the heart loses its sharpness, the contraction becoming spasmodic and confused. The sounds are always changed in character; the first is usually roughened, and either bellows or rasping; the second dull and indistinct. In many instances the heart acts so languidly, and the coagula obstruct the passage of the blood so much, that the sounds are scarcely heard; but if the muscular force be but little impaired, the first sound is almost always of a bellows kind, but usually more dull or vailed than in simple valvular obstruction. This is particularly the case where there are large coagula, but as there are cases of endocarditis in which the quantity of blood contained in the heart is, comparatively speaking, small, the disease is then chiefly limited to the valves, and we may have an intense bellows, or even rasping sound, which often supervenes in bad cases of the disease. The bellows sound is chiefly though not entirely produced at the mitral valve, and is caused by the quick and spasmodic contraction of the heart.

The cause of the bellows sound in cases of endocarditis is not at first to be ascribed to obstruction at the valve, caused by deposits of lymph, for these are only developed at a later stage of the disease. It is, in fact, produced chiefly by the violent and spasmodic contraction of the ventricle, caused by the inflammation. Later in the disease, it is true, we find that deposits of lymph take place and modify the sounds, rendering the bellows sound rougher, and sometimes converting it into a regular rasping sound.

There is an immense diversity in the degree of intensity of the bellows sound; in some cases of endocarditis it is excessively loud, and unlike anything met with in the healthy heart. This is true in many cases of acute rheumatism, in which the bellows murmur is very loud and rough. Although it is generally almost confined to the first sound, it is not always so limited, and is sometimes even more distinct in the second. At other times it is equally double,

and is then, of course, very similar to the sawing sound, which is a mere modification of the rasping sound. The bellows sound does not generally, however, pass into the rasping sound, although it sometimes does so, especially in cases in which the valves are contracted in consequence of the formation of concretions during the inflammation.

The bellows sound is not always, however, so loud or distinct as in these extreme cases. For example, in acute rheumatism, if we listen to the heart at the very commencement of the disease, we may find a slight change in the sounds; but after the patient has been ill with acute rheumatism for a day or two, a regular bellows sound is hardly ever absent if a number of the joints be inflamed. But if the disease be still limited to a few articulations, the bellows sound is comparatively slow in its development, although it is scarcely ever entirely absent. For rheumatic endocarditis results rather from a general disease of the blood than from any transfer of inflammation or secondary development of it.

Physicians have evidently labored under a mistake in looking upon endocarditis as a simple accident developed during the course of acute rheumatism. I regard it as an essential part of the disorder, produced by the inflammatory state of the blood. Hence I do not now admit of any case of severe articular rheumatism without the coexistence of endocarditis. This conclusion is one at which I have arrived but slowly; at first I was perfectly aware that endocarditis was a frequent complication, but I regarded this complication as existing only in those cases in which an intense bellows sound was developed; I did not admit its existence in cases where the bellows sound was slighter. But, from a prolonged series of observations, I have now come to the conclusion that the bellows sound, in cases of acute rheumatism, is an indication of endocarditis, and that this endocarditis must almost always be present, in like manner as the blood must become highly fibrinous, which latter condition, I think, plays an important part in the production of the endocardial inflammation.

The bellows sound is sometimes converted into the rasping. This generally results from the development of coagula adhering closely to the valves; but it also exists to a certain degree in cases

in which, although the inflammation is severe, but little deposit has taken place upon the valves. In these cases the sounds are altered rather from the mode of the muscular contraction being modified, than from the adhesion of false membranes. Still, in ordinary cases of endocarditis, the morbid sound is strictly of the bellows character; but it often has a more musical intonation than in the cases in which it is developed as a chronic sign, such as hypertrophy or valvular disease of the heart. The bellows murmur is also very different from the slighter murmurs met with in cases of functional disorder.

The distention of the heart by coagula, is one cause of rendering its impulsion feeble; and if the muscular energy of the heart be once impaired so as to permit a larger quantity of blood than usual to accumulate, a much greater energy of contraction would be required to free itself of the mass which interposes a new and mechanical obstacle to the muscular contraction. But if the heart be not much distended, or if there be not a sudden diminution of power from the violence of the inflammation, the contraction is often strong and exaggerated in endocarditis; at least there is generally something anomalous in its character, and it differs from the equable action of a healthy heart.

Hence in ordinary cases of endocarditis, the impulsion of the heart is much increased, so that it seems to strike almost as violently against the walls of the chest as in cases of hypertrophy. Of course many circumstances modify the force of the blow, which are not connected with the intensity of the actual inflammation; thus the existence of previous hypertrophy of the heart, and the greater or less quantity of red blood contained in the body, may modify the severity of the impulsion to a certain degree.

General symptoms. The general symptoms of endocarditis are often very obscure, quite as much so as those of pericarditis; that is, in extreme cases they may be violent, but in the larger number of patients they are moderate, and scarcely to be recognized without physical exploration; in another class they are so slight that the disease is nearly if not quite latent. Pain may attend it like other inflammations, but if there is no accompanying pericarditis, and no extreme obstruction to the passage of the

blood, it is often quite slight or even absent. When there is pain, it varies much in its character; sometimes it is very acute, and referred directly to the heart—that is, it is a true serous pain, but in other cases it is diffused over a large portion of the chest.

This pain is sometimes sharp and lancinating, as occasionally occurs in cases of acute rheumatism; but as a general rule, in cases of rheumatic endocarditis the pain is so moderate that it is apt to be confounded with the rheumatic pains of the disease. But very often even in acute rheumatism, when the patient's attention is called to his heart, he is either conscious of more or less pain, or else speaks of the sensation as being simply that of a disagreeable pulsation. Sometimes, however, especially in rheumatic endocarditis, the pain is either very slight, or totally absent.

Dyspnœa is also a frequent symptom, often violent, and causing intense suffering, with lividity of the lips and nostrils, and other signs of obstructed capillary circulation. In such cases, which are few in number, the patient has a haggard, wild expression, and the suffering may be more intense than from any other form of orthopnœa.

There is usually, however, a certain degree of increase in the frequency of the respiration, which arises more from the obstruction to the circulation in the heart, producing indirectly a difficulty in breathing.

The pulse sometimes affords very decided signs of endocarditis; it is then very small and irregular, but generally tense. This may be termed the type of the pulse in this disease; but how many exceptions do we find! The irregularity generally indicates a severe form of the disease, and usually depends upon valvular concretions. At first, however, the pulse is generally full and developed. Sometimes it is tense and resisting; indeed, the characters of the pulse may be easily learned, from observing it in any bad attack of acute rheumatism. There is then a high degree of endocardial inflammation which interferes with the play of the valves, and sometimes alters their conformation, almost from the beginning of the disease.

No other symptoms than those just mentioned are at all frequent in endocarditis; the organs of the body, other than those of the chest, scarcely sympathize in the disease, except at a very

late period, or when the fever is much more severe than usual. The brain is therefore clear in most patients, at least at the early periods of the disease. Occasionally, however, there is a considerable degree of cerebral disorder; this, however, is not common; when it occurs, we may always ascribe it to the impeded circulation.

The fever, of course, is precisely in accordance with the condition of the pulse, but is modified by the inflammatory disease, which may generally be regarded as the cause of the endocarditis. The ordinary symptoms of it run insensibly into those of chronic valvular disease of the heart, which follows at the end of the inflammation; hence it requires attention to discriminate between the symptoms of endocarditis and those belonging to the valvular lesions which are the results of it.

The *termination* of endocarditis is favorable in the large proportion of cases; we know that such is the result, not only from the symptoms in those cases which have recovered, but because the internal membrane bears evident traces of previous inflammation in many individuals who have died of various acute diseases unconnected with the heart. In severe cases—that is, when the valves are much altered—the disease is highly dangerous and often fatal.

When the endocarditis has been but moderate, no permanent lesion of the valves is left behind it. This absence of any permanent lesions may occur after two or three attacks of it; but after awhile valvular disease is almost sure to ensue. Very often too this disease is produced by but a single attack of endocarditis—that is, when the inflammation has been severe enough to form concretions which adhere closely to the valves of the heart, or to impair their structure. Besides, after attacks of endocarditis we very frequently find that hypertrophy and dilatation of the heart will ensue. It is thus impossible for us to pronounce with certainty whether endocarditis will end in perfect recovery or not, until the acute character of the attack has passed away.

Causes. Endocarditis, in the majority of cases, is rather an effect of inflammatory disorder than an independent disease. Hence it occurs sometimes in the second stage of pneumonia, and

in, more especially, acute inflammatory rheumatism. In neither of these cases does it always give rise to much pain or other symptoms which would direct attention to the heart, so that it may be difficult to ascertain that the disease exists without the aid of auscultation. It seems that in the diseases mentioned, the inflammation of the lining membrane is to be ascribed to the action of the blood upon the membrane—that is, this fluid is charged with fibrin, and rendered highly stimulating to the internal coat of the heart. This explanation must, however, be received with some caution, for we do not find that all inflammations give rise to endocarditis; which is rare, for example, in pleurisy. Still, in acute rheumatism, and in pneumonia, the blood certainly becomes more highly charged with inflammatory elements than it does in any other disease; and we may, therefore, think it highly probable that the endocardium is inflamed because it is in continued contact with a highly fibrinous blood. Endocarditis may sometimes be referred to the usual causes of inflammation, such as exposure to cold, local injuries, or the like; but, in more than nine-tenths of the cases of this disease, it is to be referred to acute rheumatism or pneumonia.

Diagnosis. The inflammation of the internal membrane may be confounded with that of the pericardium, or of other serous membranes of the chest. When endocarditis is the only disease the diagnosis is comparatively easy; for the dyspnœa, which is sometimes extreme under such circumstance, not being accounted for by any other lesion except inflammation of the internal membrane of the heart or aorta, may be referred to one of these sources. When complicated with pneumonia or other inflammations, the only symptoms of endocarditis which can guide us in the diagnosis are the physical signs and local symptoms, such as pain, intermittence of the pulse, etc. These are sufficient when both sets are present, but if one or two symptoms only are developed, the diagnosis is merely probable. It is not, however, so difficult as might be imagined; for as the disease is generally severe enough to give rise to a certain number of symptoms which are limited to the heart, the question is at last reduced to that of deciding between pericarditis and endocarditis.

In many cases these diseases cannot be separated, for they

coexist, and we may have the physical signs of both affections, or if the pericarditis be dry, the signs may be simply those of endocarditis. The distinction then becomes unimportant, for the disease, at least as far as both prognosis and diagnosis are concerned, is identical.

The diagnosis of rheumatic endocarditis is generally sufficiently easy, if great attention be paid to the signs of auscultation. Thus we recognize it more by the intense bellows or even rasping sound, and the increased impulsion, than by any other sign. It requires, however, attention on the part of the physician to recognize this bellows sound in every case, and to make out its peculiar character, which differs in some degree from the other cases in which the sound exists. The pain and oppression, when present, are also useful as aids to the diagnosis, but, of course, only point out a moderate proportion of the more severe cases.

Prognosis. The prognosis in endocarditis may be inferred from the remarks we have already made. Thus it is not, as a general rule, immediately dangerous; patients very rarely die of this disease. The ultimate prognosis, however, is identified to a certain degree with that of valvular disease of the heart, which follows so frequently upon the acute attack of endocarditis; hence it may be left for after consideration.

Treatment. The treatment of the disorder in the early stages, or in every stage, provided the action of the heart has not been enfeebled, is very simple. That is, full bleeding will produce relief in almost every case of moderate inflammation; in the more severe varieties the relief from blood-letting is not less decided. If the pain or dyspnœa persists, the bleeding may require to be repeated several times, especially if the bleeding be not well borne at first, although relief afterwards follows; for the heart will support the loss of blood with comparative difficulty until it is relieved of the congestion; then the bleeding may be proportioned to the degree of inflammation. In violent cases of endocarditis, blood-letting cannot be dispensed with, except at the certainty of extreme suffering and the probability of danger; in mild cases, the remedy is less positively necessary, for patients get well without being bled and without much suffering. Still, a depletory practice is certainly the surest means of preventing the

consecutive disease of the valves, which is the most constant danger in endocarditis.

We should remember, however, that cases in which the patient's strength is much enfeebled from debility of constitution, or even from the peculiar character of the disorder, will not bear blood-letting well. Fortunately it is not strictly necessary to bleed in most cases of endocarditis; although very often it is a most valuable remedy. As almost every case of acute rheumatism is evidently accompanied with endocarditis, we know that but a small proportion of cases have been treated by blood-letting, yet they have recovered. Probably, however, bleeding is a more important remedy in preventing any consecutive disease of the valves than in cutting the disorder short.

Local depletion is not quite so efficient as in pericarditis, but it is still capable of relieving patients who are too feeble for bleeding; in mild cases it is often quite sufficient, especially in those of chronic hypertrophy, in which the patient is from time to time attacked with inflammation; such persons are often accustomed to have recourse to repeated cupping with the certainty of relief. Cups bear repetition much better than blood-letting.

As to the counter-irritants, as blisters and the like, the advantages of them are much more problematical; except toward the decline of the inflammation, where there is pain remaining after the oppression has in a great degree ceased, they are comparatively of little benefit; but under the circumstances just mentioned they are of unquestionable service; a blister sometimes dissipates the remains of the disease with extreme rapidity.

The usual internal remedies for the treatment of endocardial inflammation are nearly similar to those already mentioned under the head of pericarditis. As the disease is more obstinate and more deeply seated, the usual remedies are less certain in their action. As in pericarditis, at the early stages of the disorder, we trust mainly to small doses of antimony or ipecacuanha and opium as the best adjuvants to the immediate antiphlogistic agents, provided the force of impulsion of the heart be strong; otherwise antimony is a dangerous remedy. The good effects of mercury in the declining stages of the disease are nearly similar to those

of this remedy in pericarditis; the constitutional impression should be induced slowly with small doses, unless the disease becomes extremely acute, when a prompt and decided treatment will become necessary.

In the majority of cases, however, mercury is not positively necessary. The best remedy is Dover's powder, in doses of five grains every three or four hours, or less frequently. Digitalis, in cases in which the impulsion of the heart is very frequent and strong, is a useful remedy. It should be given in doses of ten drops of the tincture five or six times a day, in the acute stage of the disease, until it produces an effect on the general system.

There is another class of internal remedies, not directly antiphlogistic, but of great service in the management of endocarditis. These are the antispasmodics, combined in some cases with digitalis. The latter remedy should be used cautiously; the advantages of it are almost limited to those cases in which the action of the heart is tumultuous and spasmodic, but not deficient in force; but in many cases and stages of endocarditis, the muscular power of the heart fails, and digitalis is totally inappropriate. In these cases the lac assafœtidæ, with twenty drops of Hoffman's anodyne, or a few drops of the ammoniated tincture of valerian, will often calm the action of the heart, and at the same time assist it to relieve itself of the blood which is constantly accumulating, menacing the patient with death by asphyxia.

The tincture of veratrum viride might sometimes be useful in severe cases of endocarditis, in doses of five drops three times a day. I should, however, be rather cautious as to its administration in these cases, from the excessive prostration which is occasionally produced by it. This might extend itself to the heart, and thus be productive of mischievous effects.

After the active period of the disease has been safely passed, there still remains in many cases some evidence of disturbed action in the heart; the pulsation may be irregular and spasmodic, and a slight exciting cause may give rise to palpitation and other disagreeable feelings at the heart. This condition arises partly from the nervous disturbance which remains after the inflammation has been subdued, and partly from the real alterations of structure which must remain after an organ has been inflamed. There is,

therefore, a double line of treatment to be pursued; the action of the heart should be kept as quiet as possible by a careful abstinence from all ordinary excitants, whether moral or physical, and if the inflammation should return, a new resort must be had to local means, with the addition of digitalis conjoined with an antispasmodic. But a very simple diet, and an avoidance of exciting causes, will be usually of themselves sufficient to prevent any serious mischief from these slight returns of the symptoms.

An error is sometimes committed in the treatment of endocarditis as well as of other affections of the heart. Depletory measures, including abstinence, are sometimes too long persisted in; there is an irritable condition of the heart which often remains after inflammation, and is necessarily aggravated by very low diet and bleeding. The remedies in this state of things are well known; a moderate diet, with some vegetable tonic, especially the cold infusion of the wild-cherry bark, will generally relieve it. Gentle exercise should be allowed after the disease has almost entirely subsided, but at the earliest stages of it, while the patient is still much indisposed, exercise of any kind will excite the action of the heart, and ought to be carefully avoided.

CHAPTER XX.

HYPERTROPHY OF THE HEART—VARIETIES—ANATOMICAL CHARACTERS—CAUSES—SIGNS AND SYMPTOMS—PROGRESS AND TERMINATION—TREATMENT.

THE heart, like all hollow organs, is subject to thickening or hypertrophy of its muscular tissue. The disease is rather one of slow nutrition than of any active disturbance, never occurring in a very short time, and resulting either from the effects of various acute diseases which have left more or less permanent lesions after them, or from some long-continued stimulant to the circulation, or impediment to it, acting slowly upon the organ.

Sometimes, however, the heart becomes affected with hypertrophy in a comparatively short period. This is especially the case when the patient is attacked with endocarditis; in this disease we have first the inflammation of the lining membrane, and almost simultaneously with it an actual increase of the muscular substance of the heart. In other cases the hypertrophy of the heart follows endocarditis, in consequence of the impediment to the circulation produced by disease of the valves.

Hypertrophy, according to Corvisart and Laennec, is divided into three varieties. The first, or simple hypertrophy, is that in which the thickness of the muscular tissue is increased, without much alteration of the valves or dilatation of the cavities. This variety lasts for a very long period, and in many cases seems scarcely to shorten the life of the patient, or to produce much disturbance of the functions. It is rather a favorer of diseases of other organs than a cause of death by the immediate derangement of the action of the heart.

The second variety is neither common nor important. It is termed concentric hypertrophy: the thickness of the walls of the heart is increased, but only in the interior, so that the size of the

whole organ does not appear at all, or at least much, greater than usual, while the walls are found to be much thickened if they are cut into, and the cavities proportionally diminished, the thickening taking place mainly at their expense. If this lesion is carried to a great degree it will produce a decided impediment to the circulation; but, in practice, this degree of alteration is rarely met with, at least to a sufficient extent to produce any well-marked symptoms.

Neither of these varieties, however, can be admitted as actually occurring in cases of disease of the heart. They are more frequently simple peculiarities of conformation, or they occur occasionally in diseases in which the heart is really not at all affected, but in which the altered state of the blood or a spasmodic contraction which occurs during the course of disease gives rise to an apparent thickening. Thus in the epidemic of cholera, which occurred in Paris in the year 1832, I remember perfectly well that Dr. Louis spoke of almost every patient whose body was examined after death, as affected with concentric hypertrophy. This mistake, however, lasted only through the beginning of the epidemic; for Dr. Louis very soon became convinced that it was owing simply to the spasmodic contraction of the heart. In my lectures on the subject, I have for many years been accustomed to teach that these varieties are scarcely ever found; and that almost all cases of hypertrophy of the heart may be set down as belonging to the third variety. I am glad to find that both Dr. Bellingham and Dr. Stokes agree with me in this particular.

The third and last variety is hypertrophy combined with dilatation, the most severe and the most intractable variety of this disease. As first mentioned, this is almost the only variety which I would admit as a proper case of hypertrophy. The danger partly arises from the direct effects of the lesion, and partly from the complications which generally precede and aggravate the hypertrophy. This disease is slow in growth, but from time to time it takes on a sudden and rapid increase from attacks of acute inflammation of the serous membranes of the heart.

Anatomical characters. The anatomical characters of hypertrophy vary, so far as the size and conformation of the heart are concerned; but they possess several features in common. The

tissue of the heart is not always increased in thickness although its volume is augmented, but it is simply spread over a larger space, remaining very nearly of its usual thickness, although it becomes harder and more resisting than the natural muscle—in some cases nearly as firm and as difficult to cut as cartilage. The color of the heart is redder than usual, and even in those cases in which the patient has become anæmic the redness persists for a very long period after the other tissues of the body have become pale. The shape of the heart remains nearly natural in concentric hypertrophy; but in what is regarded as simple, and still more in the dilated variety, the organ becomes more rounded, and approaches to the spherical form.

The appearance of the interior of the heart is also modified in hypertrophy, especially when the thickness of the organ is much increased. The columnæ carneæ are much developed, some of them becoming almost as thick as the finger; generally, however, this increase of size does not attain so great a degree, although it is always apparent. In cases in which the thickening of the heart's walls is not so great, but in which it is considerably dilated, the thickening of the columnæ carneæ is not so obvious; they are, however, even here somewhat enlarged to the eye.

It has been mentioned that the substance of the heart is redder than usual; this redness is not, however, in cases of chronic hypertrophy, exactly similar to that of a healthy heart; sometimes it is simply a deeper red, at other times, when the patient has become more anæmic, it assumes a bluish hue, as the heart never loses its color so much as the other tissues of the body.

The increase of thickness in the heart is extremely variable. In the simplest cases of hypertrophy conjoined with dilatation, the heart is not thicker than that of a man in health; its muscular substance seems, as it were, to be diffused over a larger space. But in other cases the thickness of it is much greater than is ever met with in the healthy organ. Thus it often exceeds an inch, in bad cases; very rarely it amounts to an inch and a half; in the large majority of cases of decided hypertrophy, the thickness of the wall of the left ventricle may be said to vary between half an inch and an inch. Cases of excessive thickening are not common: generally the thickness of the left ventricle is found to be

from five to eight lines. When the hypertrophied heart is struck with the finger, it sometimes resounds quite sharply, showing that the tissue is condensed as well as thickened; this resonance is sometimes described as similar to the sound produced by striking the fingers against a dice-box.

The walls of the cavities of the heart, which are most subject to hypertrophy, are undoubtedly those of the left side, both of the auricle and ventricle. We can scarcely conceive, indeed, that one of these cavities can be much modified in its thickness without the other participating. The left side of the heart is the one which is most affected, partly because its muscular structure is originally more developed than the right side, and partly because the diseases of the valves, which commonly cause hypertrophy, are nearly confined to the left side.

The right side of the heart, however, also becomes hypertrophied in almost every case of this disease; partly in consequence of the simultaneous action of the two sides, and sometimes, though rarely, from valvular disease. The increased thickening is, however, much less than on the left side.

The form of the heart, when hypertrophied, is also to a considerable degree modified; it is more rounded than in the natural state. Of course this increase of size is generally more perceptible at the left cavities.

In cases in which we examine persons after death, who have had hypertrophy of the heart, we almost always find traces of previous attacks of inflammation. Thus there are adhesions or white patches on the surface of the pericardium; there are also the marks of previous endocarditis, partly consisting in a white color of the lining membrane, and partly in thickening or alterations of conformation at the valves. Indeed, it is comparatively rare to find in a patient, dead with hypertrophy of the heart, that no traces of previous endocarditis exist.

Causes. These vary according to the nature of the lesion. In the simple variety, if we choose to admit its existence, the cause is generally mild and slow in its action, producing a gradual increase of nutrition. Sometimes the heart is disproportionately large from original conformation, or from some unknown cause acting in early life; but in general the disease rarely occurs until

after puberty, and the proportion of cases becomes greater and greater as the patient advances in life. Active muscular exertion, especially if conjoined with powerful action of the muscles of the chest, which impedes the respiration and circulation, frequent attacks of slight muscular rheumatism, nervous disorder of the heart, and, still more frequently, acute inflammation of the organ badly cured, may all give rise to this variety.

The causes of the second are unknown, but they are more frequently referable to inflammation, or to slow rheumatic attacks, than to any other; as already stated, however, I now scarcely admit its existence.

The third variety is nearly always more or less connected with inflammation, if not dependent upon it; sometimes it commences during an actual attack of endocarditis, but in most instances it occurs afterwards, and is then caused by the obstruction to the circulation which results indirectly from the valvular thickening occurring during the acute attack. The heart is thrown into violent action by the effort necessary to force the blood through the thickened valves, or to repel it backward when the opening is permanently dilated. There are other cases, although less frequent, in which no acute cause can be discovered, and the hypertrophy results either from long-continued muscular efforts, or from slowly acting irritation, especially gout or muscular rheumatism.

The most common cause of decided hypertrophy is the endocarditis and the valvular disease which occur during attacks of rheumatism. This is especially the case with children, who are very rarely affected with a violent attack of rheumatism without some hypertrophy and dilatation of the heart following it. Sometimes this is intensely severe, and often it causes the death of children. In adults, acute rheumatism is less and less apt to produce decided hypertrophy of the heart, in proportion as the patient advances in life. That is, the structure of the heart seems to be firmer, and yields less readily to the intercurrent endocarditis. Still, acute rheumatism does very frequently develop hypertrophy of the heart at any age of life; but in persons who are advanced in years it is more immediately a consequence of the valvular disease thus produced, whereas in young persons I believe that the

hypertrophy results partly from the disease of the valves, and partly from the impression produced upon the muscular structure of the heart during the acute attack.

Physical signs and symptoms. The physical signs of hypertrophy are generally quite conclusive. In the simple varieties they belong exclusively to the lesion itself, but when the heart is dilated the signs are more or less mingled with those of valvular disease and of dilatation.

In hypertrophy we have three well-defined physical signs: the first of these is the increase of the impulsion. The force of impulsion depends partly upon the quantity of muscle and partly on its power or activity; and, as in hypertrophy, the thickness of the heart is increased, while its tissue becomes stronger and firmer, there is necessarily an increase in the power of impulsion, which is only lost when the energies of all the muscles decline on the near approach of death. The impulsion is not only increased in force, but in extent, the heart evidently applying itself over a larger surface, and raising itself gradually against the ribs with a heaving motion, which is totally different from the short, quick stroke of nervous or functional disturbance. In other words, there obviously is a positive increase of momentum dependent upon a large mass pressing against the walls of the chest.

In all the varieties of hypertrophy the increased impulsion forms one of the most characteristic signs, but it is of course less in the more moderate than in the other varieties, in which the size of the organ, considered as a whole, is increased. It is greatest in some cases of hypertrophy with dilatation, in which the walls of the heart are excessively thickened. The increased force of impulsion may be readily calculated by a reference to a normal and a hypertrophied heart; in the natural state, the thickness is not usually more than a third to half an inch, measured at the middle of the left ventricle, which we generally take as the standard. The normal thickness of course varies just as that of any other muscle of the body, depending upon the general development of the individual, the sex, stature, etc. Hence the heart is rather thicker in males than in females, and in those who have followed laborious employments than in persons who have led an idle, inac-

tive life; in the well nourished than in those whose digestion is impaired, or diet insufficient.

The mode in which the impulse is formed is also peculiar; instead of a short decided stroke, it is heaving—that is, point after point of the heart is applied against the walls of the chest, which gives to the observer the sensation of a large massive organ, and not simply increased energy and rapidity of blow. As the total size of the heart is greater in true hypertrophy—that is, hypertrophy with dilatation—than in any other variety, the heaving motion is then of course most perceptible.

The sounds of the heart are more or less changed in hypertrophy: even in the most simple variety they become less sharp, especially the second sound, and the first is more or less prolonged, approaching insensibly to the bellows sound. In some cases the second sound disappears entirely; in others it retains its natural distinctness; and in the third variety it may even become louder than natural; for as the necessary effect of dilatation is to increase the loudness and sharpness of the second sound, the deadening effect of the hypertrophy is more than neutralized. In such cases we often find a prolonged and rough bellows sound, while the second is clear and distinct, but the valves must of course in this case remain in the normal condition.

The sounds of the heart, in hypertrophy, are generally combined with those produced in valvular disease; for it is very rare for the heart to be much enlarged without the valves being to a considerable degree altered. Hence it is really difficult to determine how much of the altered sounds is referable to each of these causes. Still, even in the most uncomplicated case of hypertrophy, there is always at least a bellows sound, produced mainly at the mitral valve; for a heart whose left ventricle is preternaturally large cannot pass the whole current of blood through the aorta; a portion of it must regurgitate through the mitral valve, and thus produce a considerable degree of bellows sound from that circumstance. But the simple enlargement and dilatation of the heart will of itself produce some degree of the same sound.

The degree of hypertrophy may also be measured by percussion and by the prominence which is almost always produced after a time. The prominence is most readily formed in young persons

whose cartilages are elastic, and yield readily to the long-continued efforts of the heart beating against them. Like the enlarged heart, the prominence is more or less oval in shape, and is of course much greater in those cases in which hypertrophy is conjoined with dilatation than in the simpler varieties. In some cases it is very distinct, but we must take care not to confound the cases in which a slight prominence exists naturally with those in which it is dependent upon the hypertrophy. In the latter case it is generally better defined, and limited to the situation of the heart.

The results of percussion are much more satisfactory; not only do we ascertain the actual limits of the heart, but we can, with much accuracy, ascertain if the thickening is particularly great at the center of the organ. In such cases the dullness of sound is replaced by complete flatness over the center, and although the extent of dullness may not be increased much beyond its natural limits, it may become so much more evident, and so much greater in degree, that our diagnosis is equally sure. In cases where there is no dilatation, the degree of dullness at the center of the heart is very great, and it then is a much better indication than the mere extension of it.

Percussion is, in most cases, an excellent mode of detecting hypertrophy of the heart. It will not, however, answer very well in those cases in which the patient is overloaded with fat, as it is then comparatively difficult to perform it. In cases in which there is marked emphysema, the percussion is also uncertain, owing to the clearness developed over the heart. Still, as a general rule, this means of investigation is exceedingly useful in cases in which the hypertrophy is very great; the dullness or flatness of percussion will sometimes extend to the right side of the sternum, and pass upward to the third rib, reaching on the left side sometimes even beyond the nipple. These extreme cases of flatness upon percussion are met with particularly in children who are affected with hypertrophy of the heart.

The sensations felt in the chest by the patient are at times a good guide for the diagnosis. If the chest should happen to be narrow and the heart more or less compressed, the strong impulsion is proportionably much more distressing to the patient,

who then complains of the violent throbbing; but a full, capacious thorax with firm ribs, is by no means so apt to feel the impulsion, and the thickening may go on to a great degree without causing much uneasiness. In general the patient suffers much palpitation whenever he attempts to exert himself, as by walking quickly up stairs, or ascending a hill, or if he is under the exciting influence of moral causes, or, in fact, from any circumstance which quickens the motion of the heart. Frequently he is obliged to stop suddenly, and the heart may then be felt violently palpitating.

Besides the palpitation there is often much suffering from dyspnœa, which arises partly from the difficulty of expelling the blood from the heart, if the auriculo-ventricular valves should be patulous, or the semilunar valves contracted, and partly from the secondary effects of this impediment, which congests the lungs and prevents their full expansion.

Pain about the region of the heart is also often complained of; this is directly dependent upon the disease, and is vague and wandering, sometimes extending down the left arm, as in other diseases of the heart, or it is secondary, and depends upon the accidental attacks of inflammation of both serous membranes of the heart, which are almost sure to recur from time to time. In many patients there is scarcely pain, but merely a vague sense of uneasiness, at times scarcely felt, at others more resembling that of a weight pressing at the region of the heart.

The vascular system is necessarily affected in cases of hypertrophy. The arteries are strongly distended by the powerful action of the enlarged heart, unless the aortal valves are contracted, when the pulse may become small and irregular; this, however, results from the latter cause, and not from the hypertrophy itself, which always tends to increase the firmness and fullness of the pulse. The capillary system feels the impulsion as well as the arterial, and congestions often occur at different parts of the body; hence the subjects of hypertrophy are liable to hemorrhages, especially from the nose and the lungs, to hemorrhoids, and to apoplexy of the brain and lungs. The hemorrhages become less frequent as the strength of the patient declines and the congestions connected with them become more passive in their char-

acter; but in the early periods of the disease the natural effect of a strong impulsion of the heart is nearly always perceptible upon the capillary system. The passage of the blood through it becomes obstructed, and external hemorrhage is a natural mode of relief; but if it should chance to be internal, though this is a similar effort of nature to relieve the vessels, it often becomes a cause of death. The veins are very little distended in simple hypertrophy; like the rest of the vascular system, they are generally well supplied with blood in the early stages of the disease, but they do not present any marked pulsations unless the tricuspid valve should yield to the continual stretching of its fibers, when regurgitation is apt to take place, and, of course, pulsation of the veins follows. The dilatation of the valve and distention of the veins are most apt to occur in the third variety of hypertrophy—that is, in true hypertrophy, because it must participate after a time in the general enlargement of the cavities of the heart.

The disorders of other organs than the heart nearly all depend upon the abnormal condition in which the whole vascular system is placed; and result mainly from the fullness of the capillary system. Thus, cephalalgia is a very frequent accident; when it occurs, it is usually throbbing, deeply seated, and accompanied with giddiness, flushing of the face, and other signs of active congestion. This symptom frequently is connected with a strong tendency to cerebral congestion, and sometimes to actual apoplectic effusion. But as soon as the blood has become watery, congestion of the brain scarcely takes place except after exercise, mental excitement, or other causes which excite the circulation. Absolute rest will almost always prevent it. The tendency to congestion of the lungs has been already mentioned as a thoracic symptom; still it is secondary to the disorders of the heart proper, and only indirectly connected with the disease.

The viscera of the abdomen rarely escape. The disorder of the liver is much more frequent than that of any other organ of this cavity; in its simplest form it is a mere engorgement, the distention of the vessels of the organ arising from the difficulty in the venous circulation; hence the organ enlarges, is indurated, and of course interferes with the due performance of digestion, and, to a certain extent, impedes respiration. But if the engorgement con-

tinue, the usual change in the condition of the liver takes place, its nutrition is deeply altered, the acini in part enlarge and become indurated, and in part are pressed upon by those which are already increased in size: it loses the deep-red color of early congestion and assumes a yellowish tint; in other words, decided cyrrhosis is formed. The symptoms proper to the liver, as jaundice, etc., are often developed, and the case might be mistaken for one of original disease of this organ, unless the attention is drawn to the history of the symptoms and their evident starting-point in the heart itself.

Flatulence is another frequent symptom; it seems to arise from the disordered digestion which often accompanies hypertrophy, and is more marked than in other affections, because the impediment to the action of the heart, which arises from the distended abdomen, causes extreme dyspnœa.

The kidneys frequently participate in the disorder; generally they are not diseased until the liver has previously suffered, and the affection then becomes a triple one, which is almost always followed by dropsical effusion much earlier than the uncomplicated disease of the heart. The disease of the kidneys ends, if it does not begin, by the peculiar alteration of the cortical substance known under the name of granular degeneration, which is singularly analogous to the cirrhosis of the liver, and seems to depend much upon the same causes.

In advanced cases of hypertrophy of the heart, the patient is usually taken with dropsical effusions. These begin, of course, at the extremities, and then are rapidly formed in the thorax—both pericardium and pleura being the seat of effusion, unless there have been old adhesions, which of course prevent any accumulation of liquid. Last of all, we have the dropsical effusion developed in the abdomen; so that the patient may ultimately die of the accompanying dropsy, and not directly from the disease of the heart. These cases were formerly all considered as simply instances of dropsy; the heart was scarcely ever considered as the cause of them, except when the palpitation was intensely violent. Indeed we do not now regard the dropsy as in every case produced exclusively by the disease of the heart. The accompanying disorders of the kidney and liver both may play important parts

in developing serous effusions. They, however, arise in cases in which the heart alone is affected, without the complication of diseases of the other organs to which we have just alluded.

Dropsy does not usually occur in hypertrophy of the heart, except in cases early complicated with disease of the liver or kidneys, until a comparatively late period of the disorder, when the blood is to a certain degree broken down. We sometimes, however, meet with cases in which the dropsical effusion occurs, when the patient's vascular system contains a large quantity of blood, so that he is even plethoric. These cases are, however, less common than the others, and are usually much more manageable. It is comparatively easy to get rid of the secondary effusions when the patient's vessels are well supplied with blood, and extremely difficult to do so when he has become anæmic.

Progress and termination. In many cases, hypertrophy, if of the kind connected with dilatation, tends to pass to a more advanced stage, and the progress of the disease is therefore toward a fatal termination. This is generally the case at an earlier or later period, unless the patient avoid all causes which are capable of producing a quick and excited action of the heart. Death may take place in one of two ways: either suddenly, especially when the circulation is hurried for the moment, or more slowly, from gradual exhaustion and dropsical effusions. In the more simple varieties the progress of the disease may be often arrested, and even in the worst cases of these varieties it is so slow that it scarcely shortens the ordinary duration of life, unless it should produce some secondary disorders of other viscera, such as the liver or lungs.

There are, however, many cases of moderate hypertrophy in which the life of the patient does not seem to be placed in jeopardy by the disease, the only inconvenience suffered by the patient being a quick palpitation of the heart on exercise, and an inability to perform very laborious or exhausting labor. Thus this will sometimes occur in early childhood; a striking instance of this occurred to me many years ago, in a gentleman now resident in this city. He was brought to me by his father, in the year 1836, laboring under decided hypertrophy, with dilatation of the mitral valve; he is still living in the enjoyment of good health, with the

exception of some degree of palpitation. These cases, however, in which the disease is so extremely moderate in its effects, are usually congenital, or else they are cases in which there is little or no accompanying disease of the liver or kidneys, and no valvular contraction.

Diagnosis. The diagnosis evidently depends mainly on the physical signs; for, though the oppressive palpitations and disagreeable sensations of the patient are all more or less indicative of the disorder, none of these signs are sufficient; even when taken together they are rather uncertain evidences of the disease. The physical signs, depending on the measurement of extent and of impulsion, are much more easy and certain, and can rarely lead into error. The chances of mistake are, in fact, reduced almost to nothing if the physician examine the patient at several times and find that the signs vary but little. For the strong impulsion of a hypertrophied heart is very different from the quick jerking motion of one that is merely excited by some temporary functional disturbance.

A strong bellows sound is also an indication of considerable importance; and when we find that the impulsion is transmitted to the arteries of the neck, or that the veins are distended, the diagnosis is clearly that the patient has hypertrophy. The real difficulty in diagnosis, however, is not to determine whether this disease does or does not exist, but what is the nature of its complications, and how much the valves are diseased. For we must remember that simple hypertrophy scarcely exists to any great degree; it is almost always connected with more or less valvular lesion.

Prognosis. The prognosis of hypertrophy is so completely dependent upon the progress of the disorder as to require very few remarks. If the patient retain a full vascular system, without suffering from extreme dyspnœa on moderate exercise, and without a constant tendency to visceral engorgements, the immediate prognosis is not very unfavorable. If he become anæmic, and still suffer from much palpitation and oppression, the prognosis becomes extremely grave, for the strength declines while the local disease continues unabated. The rapidity of increase of the heart, and the ossification of the internal membrane also in-

crease the danger, especially if the latter occur in the valves of the heart, as well as in the arteries.

When there is much valvular disease complicating it, the prognosis, of course, becomes modified; but then it belongs rather to the disease of the valves than to the hypertrophy, the enlargement of the muscular tissue of the heart being in fact often a favorable occurrence. It is a mere secondary lesion, which rather prevents than increases the mischievous effects of valvular disease. Hence we regard the existence of hypertrophy in these cases as of favorable import to the patient.

Treatment. Hypertrophy being either originally a disease of nutrition, or becoming so after a previous inflammatory disorder, it is very clear that no active antiphlogistic treatment can be decidedly curative. Indeed, all treatment is simply palliative, designed to check the stimulation of the heart and allow the natural powers to recover themselves, and, if possible, to regain the balance which is lost.

The principal indication is, therefore, to keep the heart as quiet as possible by withdrawing all unnecessary stimulants, and by moderating that excess of action and of nutritive life which it has already acquired. Many of our most important means are, therefore, strictly hygienic, and these are among those whose utility is unquestionable.

A patient who is affected with hypertrophy must be informed that no sudden cure is possible, and that the amelioration of his symptoms must depend in a great measure upon the energy of his will, and his perseverance in watching the influence of stimulating agents upon the heart. He should carefully avoid all active violent exercise, carrying heavy weights, or even walking fast, all extreme mental agitation, the use of stimulating drink, or of an exciting highly animalized diet, coffee, tobacco, and other nervous excitants, among which excessive venereal indulgence is one of the most pernicious. Moderate exercise by walking, driving, or riding at an easy pace, is not to be forbidden, except for a short period during some temporary excitement of the heart; and the diet should not be extremely rigid; it must be plain but sufficient, with animal food in moderate quantity once daily.

It was at one time laid down as a rule, that in every case of

hypertrophy the patient should be put upon a very rigid diet, and the treatment of Valsalva was looked upon as that best adapted for the cure of the disease. It is, however, obvious to all men of much experience, that this mode of treatment is, generally speaking, absurd; for although a limited diet is proper in every case in which the patient is full or plethoric, yet, at the same time, the mischievous effects of hypertrophy are generally most marked when the patient becomes anæmic; it is then that dropsical effusions are most apt to occur. Hence we regard it as important that the patient's strength should not sink below a certain standard, and that he should not become anæmic. If this result does take place, dropsy and other mischievous consequences almost always ensue.

In moderately severe cases, the hygienic treatment, with the occasional application of cups to the region of the heart, will best insure the comfort of the patient. Cups may be used whenever the action of the heart becomes oppressed, or its impulsion decidedly increased. General blood-letting will produce relief under the same circumstances, and is habitually resorted to by many patients; but there are some decided objections to its repeated employment. If prescribed frequently for the relief of slight cardiac disturbance, it must be again resorted to whenever the necessity returns; and it will be required more and more often as the patient becomes more feeble, and the blood less rich; for it is a general law, that venesection will relieve a chronic disease of the heart by lessening the quantity of blood which obstructs the action of the organ; but it increases its irritability and enfeebles the patient, while at the same time it favors dropsical effusions. It is, therefore, really a necessary evil. The objections to the use of cups are by no means so strong, nor does the application of them produce the same necessity for their frequent repetition.

In all cases in which the disease is not positively active, we restrict our remedies to those just mentioned, but from time to time the hypertrophy seems to advance rapidly, the patient suffers more, and the throbbing is almost incessant. This results from accidental inflammation, or from temporary excitement. Blood-letting is then sometimes necessary to relieve the oppres-

sion, but it must be regarded as a purely temporary remedy, not to be repeated unnecessarily, or carried to a large amount. After a moderate bleeding to diminish the violent throbbing of the heart and arteries, the patient should keep as quiet as possible during the attack, not taking active exercise of any kind. By these means the temporary excitement may in general be speedily removed.

The use of digitalis is at times indicated, but, like blood-letting, it is better adapted for the removal of temporary attacks of palpitation and excitement than for the radical cure of the disorder. If it be administered for a long period, it either loses, in a great degree, its peculiar control over the heart, or it must be urged to an extent which is dangerous, from the uncertainty of its action when accumulated in the economy. For these reasons I have in a great measure abandoned the digitalis as a permanent remedy, restricting it to a few cases in which it acts powerfully in small doses; and even in these cases I prefer giving it with assafœtida or camphor, to prescribing it alone.

But when the hypertrophied heart is excited, either from inflammation or other causes, digitalis is safe and highly useful as an adjuvant to more certain antiphlogistic means. It may be prescribed in the usual doses of ten drops of the tincture three or four times a day, or from two-thirds of a grain to a grain of the powder at the same intervals. I have never in these doses seen any inconvenience result from it where its action was watched. The infusion as usually prepared is extremely uncertain, but if it be made carefully, and of given strength, with the addition of a sufficient quantity of sugar to make it into a sirup, it is more powerful than the tincture; but as it sometimes acts with excessive energy I now rarely use it, and do not think it should ever be prescribed in the treatment of hypertrophy. After the temporary excitement of the heart is quieted, the digitalis may be laid aside for a time, and again resumed when a like necessity arises.

The veratrum viride may sometimes be substituted for the digitalis, in doses of five or six drops of the tincture, three or four times a day. It produces to a great degree analogous effects, and when there is much excitement of the heart, is capable of controlling it. But, as I have already remarked, I do not con-

sider this remedy as in all respects safe, unless used with great caution.

When there are dropsical effusions in hypertrophy, whether combined or not with disease of the valves, diuretics become necessary. There is none superior to the old-fashioned prescription of calomel, squill, and digitalis. The calomel, however, should be used only for a short time; the digitalis may be given until the action of the heart is in some degree impeded.

The object, then, of the treatment is to remove the causes which increase the tendency to hypertrophy, to keep the heart as quiet as possible, and to arrest the action of those accidents which hasten the progress of the disease by giving a new activity to the growth of the organ. The clothing of the patient must be carefully attended to; without being oppressively warm, it should obviate as much as possible the rheumatic attacks which favor heart diseases.

CHAPTER XXI.

DILATATION—ANATOMICAL CHARACTERS—CAUSES—SYMPTOMS—DIAGNOSIS AND PROGNOSIS—TREATMENT.

THIS is enlargement of the cavities of the heart. One variety of it is, as we have already seen, connected with thickening of the parietes of the heart, and is, therefore, properly considered as belonging to hypertrophy rather than to dilatation; but it also occurs as a distinct lesion, and then the parietes of the heart are in general not only free from thickening, but are rather thinner than natural. It is in itself by no means a formidable disease, but as it often is connected with different organic lesions, or with embarrassing nervous disorder, it may indirectly prove to be a source of great annoyance and even danger to the patient.

The causes of dilatation are nearly the same as those of hypertrophy; but, in the latter disease, the general state of the individual is more disposed to active nutrition of a semi-inflammatory kind, while in dilatation the force of resistance of the heart is in a great degree lost, and the organ becomes thinner and weaker. Hence it is more frequent in anæmic individuals, especially in chlorotic girls, than in any other class of persons, just as hypertrophy is more frequent in males. The tissue of the heart is paler and more flaccid than in hypertrophy, and there is very rarely that complication of endocarditis or pericarditis which renders the membrane of a hypertrophied heart so often opake and thickened. The degree of dilatation is very various; it never, in the simpler variety, reaches nearly to the degree observed in the cases complicated with hypertrophy, for the plain reason that the powers of the muscular structure of the heart would yield to the continual stretching, unless it were increased

in thickness: hence there is a natural law of the economy that a dilated hollow organ tends to hypertrophy. Dilatation, then, often ceases to be simple, from the natural operation of this law. The organic lesions most frequently conjoined with dilatation are the disorders of the valves, especially the auriculo-ventricular. These are more frequently extreme patescence than thickening and contraction, and in some cases of dilatation the symptoms begin so suddenly, and with so much force from the first, that it would seem that one or more of the chordæ tendineæ had given way, producing a sudden inability of using the valves.

Physical signs. The physical signs are less marked than those of hypertrophy. The percussion is rarely dull to the same extent, as it depends merely upon the blood contained in the heart, and not on the addition of solid muscular structure: it must, however, necessarily be more dull than usual, and the dullness will extend over a greater space. There is no prominence, for the heart has not force enough to act upon the ribs and oblige them to recede. The chief signs, however, of dilatation are the changes in the sounds of the heart. The thinness of the parietes increases the sharpness and loudness of the first sound, much as the thickening of hypertrophy renders it dull and less distinct; it therefore approaches, to a certain extent, the sharpness of the second sound. The latter is also increased, and becomes much more clacking than it is in the healthy heart. The rapidity of the heart's action is in most cases increased, sometimes to a very great degree, and slight causes produce palpitation.

General symptoms. Pain is not unfrequently complained of by the patient; sometimes it is sharp, but in general it is like the pain in most cases of organic disease of the heart—that is, dull and indistinct. When the pain is most severe, the case is generally complicated with functional disease of the heart. The disturbances of the capillary circulation of various organs, which are so apt to occur in hypertrophy, rarely take place in simple dilatation, so that the vascular symptoms of this disease are less evident.

As dilatation occurs chiefly in individuals of a nervous temperament, often more or less anæmic, many disturbances are apt to occur in the nervous condition of the patient; hence neuralgia in

its various forms and hysteria are frequent complications. There is no other symptom properly dependent upon the disease, but a large number of functional disorders may either precede or accompany it, and modify the action of the heart. Hence complications of this kind are purely or nearly accidental. The most important is the general feebleness of the patient; as long as this continues, the action of the heart is rarely restored to its normal state, for the functional disturbance keeps up, as it were, the symptoms of dilatation.

Diagnosis and prognosis. The diagnosis of dilatation and the organic diseases of the heart is not very difficult; but it is often extremely embarrassing to decide between it and nervous disorder—that is, to ascertain how much of the symptoms is owing to each of these causes. The distinction depends on the signs of dullness found in dilatation, and the permanent loudness of the sounds of the heart, which is much greater than in the nervous disease; still, it will often be exceedingly difficult to decide whether a heart which is the subject of great functional disorder is dilated or not. A hasty opinion must not be formed under such circumstances; but by attention to the progress of the disorder its true character will be developed. In this, as in other diseases of the heart, the functional affections are more or less temporary, the organic alterations are much more permanent, and although they may subside for a time, they do not entirely disappear, unless a real recovery should occur. The prognosis of the disorder offers little of interest; it is scarcely fatal of itself, but as connected with other disorders it may undoubtedly exercise a certain agency in favoring and hastening their progress. A patient hardly ever dies of simple dilatation.

Causes. The cause of dilatation is in some cases valvular disease; this is, however, generally complicated with hypertrophy, for dilatation of the heart is not often produced as a simple disorder after disease of the valves. Still, cases are occasionally met with in which the heart is dilated in consequence of valvular obstruction; and at the same time the muscular substance is so much thinned as to constitute a real case of dilatation. This, however, is not frequent; dilatation results rather from the feeble condition of the individual, producing a partial atrophy of the

general muscular structure of the body, and in that way affecting the heart, than from any other cause.

Treatment. In dilatation, as well as in hypertrophy, the treatment is not active, so far as our means of acting directly upon the heart extend. Our object is to tranquilize the action of the heart, and to support the strength of the patient, if, as often happens, it be much enfeebled. The pain which sometimes attends dilatation may be relieved by small blisters over the region of the heart, and even to the spine in those cases in which the action of the heart is in a great degree kept up by spinal irritation. Blistering or other revulsives to the spine may cure the patient of the palpitation, and the dilatation will then present few symptoms of importance. The action of the heart in dilatation is not powerful enough to require the use of large doses of digitalis; if this remedy be administered it should be given only for a short period, and in very minute doses, conjoined with aq. camphoræ or lac assafœtidæ. Hoffman's anodyne answers very well for the same object, as a temporary tranquilizing remedy. The use of these various remedies is readily learned, when it is remembered that the power of the heart should not be diminished, but that its irregular action merely should be checked. For the same purpose a rigid adherence to hygienic rules becomes necessary, and they should be nearly the same as those required for the treatment of hypertrophy. But as the nervous stimulants are more to be dreaded in dilatation than the more permanent excitants of the heart, the patient should carefully abstain from tobacco, tea, coffee, and avoid the mental and physical excesses which disturb the regular cardiac action. Those which act through the passions, or debilitate the nervous power by excessive fatigue from indulgence in sensual gratification, or undue culture of some of the faculties, are the most injurious.

If anæmia complicates dilatation of the heart, a long-continued use of tonics, especially the chalybeates, constitute the best mode of treatment. The prescription which I formerly preferred, as a general rule, was Vallet's proto-carbonate of iron, in doses of three to five grains, with half a grain of rhubarb and a grain of ginger; of these pills, the patient may take from three to four daily. A still better preparation is the metallic iron, or the iron

per hydrogen, as it is sometimes called, given in very small doses, as two grains three times a day. The infusion of Prunus Virginiana is an adjuvant to the chalybeate remedies of great value, and often succeeds in quieting the action of the heart. A simple infusion of quassia, sometimes conjoined with a moderate quantity of ale or porter, will be found in some cases a useful remedy. Cold-bathing, sea-bathing, and other tonics of this nature, are all necessary from time to time, and may be prescribed with advantage, as they tend to strengthen the general muscular system, and to increase the nutrition, without exciting the irritability of the heart.

CHAPTER XXII.

DISEASES OF THE VALVES—ANATOMICAL LESIONS—SIGNS AND SYMPTOMS—DIAGNOSIS—TREATMENT.

THE valves of the heart are subject to derangements, either from the direct effect of inflammation, or chronic alterations of nutrition, or the combined influence of these causes. When the valvular lesion occurs during the active progress of endocarditis, it is evidently a mere result of the inflammation, and is produced by the same action of the blood-vessels as other alterations of structure of serous membranes. The valves are altered by deposition of lymph upon their free surface, under the form of vegetations or granulations, and by thickening from an albuminous deposit between their thin laminæ; lastly, from bony degeneration, which follows cartilaginous thickening. The vegetations produce not only thickening, but also roughness of the surface of the valves; while deposits between the laminæ of the valve indurate and thicken without destroying its polished surface. Bony concretions of course produce great obstructions to the passage of the blood, and in some cases are as important lesions as more recently formed vegetations.

Another cause which occasionally gives rise to lesions of the valves is a sudden strain, or violent muscular exertion, which of course quickens the circulation through the heart, and at the same time brings such a strain on the valve as to rupture one of its tendons. After such a rupture has taken place, the valve is more free in its motion than it was in its healthy condition: afterwards new alterations occur from the deposit of lymph, which of course change its form still more. But the most frequent source of valvular disease is certainly inflammation of the endocardium, attacking particularly the valves.

Anatomical lesions. These changes produce alterations of function—that is, as the valve changes its form it becomes incapable of closing completely and preventing the reflux of the blood; or it becomes morbidly contracted, forming a projection inward toward the cavity of the heart, obstructing more or less the circulation. In most cases it can scarcely be said that the opening of the valve is simply contracted or dilated; for a permanent thickening destroys both the form and functions of the valve, and converts it into a rigid abutment, which does not yield itself completely either to the movements of dilatation or contraction; hence the orifice of an indurated valve is generally both dilated and contracted, neither closing nor opening so as to give a free passage to the blood.

The form assumed by the lymph when first thrown out during inflammation is various; sometimes it is in small points or granulations, at other times it forms excrescences, singularly like, in appearance, to venereal warts; hence they are sometimes called cauliflower vegetations. In a third variety the lymph is spread out on the internal membrane with which it is intimately combined, giving to it an opake white tint. In other cases, the effused matter is secreted into the thickness of the valves, and of course is situated between the folds of the membrane which forms them. This matter is replaced in many instances by ossific deposits, which are formed in the usual way beneath the lining membrane, which often ulcerates, leaving the bony spiculæ projecting toward the cavity of the heart. The structural alteration of the valve, in some cases, takes place immediately after, or even during the inflammatory process; in others it is only formed after the inflammatory action has subsided, and the affection becomes limited to a mere alteration of nutrition. In both cases the action of the vessels is the same; and when the lesion is once formed it scarcely diminishes afterwards.

The valves of both sides of the heart are liable to disorder; but there is a great difference in this respect. Those of the left side, according to the usual law as to the relative frequency of inflammation in the arterial and venous structures, are diseased in the immense majority of cases. Indeed, almost always exclusively so in those cases in which the alteration is positive or active

in its nature, and depends upon increased nutrition. Disease of the valves of the right side exclusively scarcely ever occurs; Dr. Chambers says once only in three hundred and sixty-seven cases. I have met with it occasionally, but not oftener than that. The giving way of the valves which follows long-continued dilatation is quite as apt to take place on the right side in the tricuspid as any other lesion.

The valves of the left side are generally both affected at the same time; hence the semilunar and mitral are usually both diseased; in some cases, one is decidedly altered while the other nearly escapes, but it is very rare to find it in a normal state. They both participate in the disorder, because as the lesions are the result of inflammation in most cases, and as it extends usually over the greater part or the whole of the ventricle, therefore neither valve absolutely escapes. Still, as a trifling lesion is not sufficient to give rise to much or any notable disturbance, the symptoms very generally depend on the affection of the valve only which is most altered. The disorder of either semilunar or mitral will produce grave results, if carried to an extreme degree; but the mischievous effects are in general more severe in affections of the aortic than of the mitral valves. When the semilunar valve is contracted or dilated, the cavity of the left ventricle remains full; for the blood is either prevented from passing quickly into the aorta, and thus accumulates in the ventricle, or it regurgitates into it: but if the mitral valve be much contracted, the supply of blood becomes at once irregular, and the ventricle no longer contracts in a steady uniform manner. In such cases the pulse is most frequent and irregular, and the dyspnœa is then excessive.

The ordinary lesion of the mitral valve, however, is rather dilatation than contraction. Thus the blood passes into the ventricle freely, and, as that is usually at the same time hypertrophied, dilates it in a notable manner; but at the same time it allows of free regurgitation. Hence, although the circulation of the blood is interfered with, unless the heart is thrown into violent action the patient usually suffers less than might be imagined, so that his life is often not much endangered. The cause of this mitral disease is generally direct inflammation; and as endocarditis so frequently results from rheumatism as almost to form an append-

age of this disease, we may say that the mitral lesion is in most cases a mere result of rheumatic disorder. This lesion, however, takes place only through endocarditis; hence we have to inquire what is the result of this disorder in producing a permanently altered state of the valves.

It was already stated, under the head of endocarditis, that the immediate results of inflammation were, in the first place, a thickening from the deposit of lymph upon the valve, and in the second an analogous lesion taking place in its thickness. Now if the inflammation be but moderate, all traces of disordered valvular action may cease with the recovery from the inflammatory attack; but there are numerous cases in which, although all traces of the inflammation have passed away, the lesion of the valves remains and constitutes a permanent alteration.

As these lesions are either thickening, resulting from a permanent alteration of nutrition, or excrescences forming upon the surface of the valves, there is generally, both at the semilunar and at the mitral valves, a permanent and a double alteration. That is, the valve cannot contract sufficiently to close the opening as nearly as it would do in the natural state, nor again can it be sufficiently opened to allow of the free passage of the blood. Hence we often have the double murmurs.

The semilunar valves are less frequently affected after inflammation than the mitral. That is, they are not often altered to a sufficient degree to produce a great impediment to the circulation of the blood. Still, in some cases, where the inflammation has happened to attack particularly the semilunar valves, we may find as great changes in their structure as occur at the mitral; they may be shrunk up or covered with concretions, and sometimes may be affected with ulceration. The latter lesion is much more common at the aortic valve than at the mitral.

Disease of the valves, however, even when immediately following inflammation, is not invariably produced by rheumatism; for endocarditis may occur independently of this disease. But cases of valvular lesion, following any attack of endocarditis, are of course precisely similar to those met with in acute rheumatism. Certain chronic disorders, such as gout or gouty affections, are also capable of inducing disease of the valves; in this case the

lesion is not precisely similar to that observed in cases of rheumatism. There are sometimes concretions upon the surface of the valves, but there is not usually the extreme thickening observed in rheumatic disease.

There is another lesion of the valves, always met with in persons advanced in life; and this is cartilaginous or bony deposition.

There is still another variety of disease of the valves, which is of course strictly secondary to disease of the substance of the heart, particularly to hypertrophy and dilatation—that is, when the cavities of the heart are much enlarged, the valves are necessarily put upon the stretch, and after awhile become altered. This, of course, is unlike the ordinary cases in which endocarditis has first occurred, and been followed by hypertrophy. It is in fact just the converse of this condition; but the alteration of the valves is much less marked than in those cases which have been preceded by endocarditis.

As to the relative frequency of disease of the right and left sides of the heart, I may refer to the reports of Dr. T. K. Chambers, (Brit. and For. Med.-Chir. Review, vol. xii., 1853.)

This author, in his *Decennium Pathologium*, states that chronic disease of the valves was met with in 367 out of 2161 bodies examined. The valves were thickened or contracted in 156, and exhibited chronic morbid deposit in 211 of these cases.

Of the 156 cases of thickened or contracted valves—

The mitral and aortic were affected simultaneously in	50
The aortic alone	48
The mitral alone	37
The mitral and tricuspid	8
The mitral, aortic, and tricuspid	5
All four sets	4
The tricuspid alone	1
The tricuspid and aortic	2
The aortic and pulmonary	1

Of the 211 cases with chronic morbid deposits—

The mitral and aortic were affected simultaneously in	71
The mitral alone	59
The aortic alone	59

The aortic, mitral, and tricuspid - - - - -	6
All four sets - - - - - - - - -	5
The mitral and tricuspid - - - - - -	2
The aortic, mitral, and pulmonary - - - -	2
The aortic and pulmonary - - - - - -	2

These views are quoted by Dr. Bellingham, in his work on diseases of the heart, with approbation.

Physical signs. The physical signs of valvular disease vary according to the valve affected, and the nature of the lesion. When contraction of the semilunar valves of the aorta predominates over dilatation, the blood is driven with difficulty through them by the contraction of the ventricle; hence we have a bellows or rough rasping sound developed in the systole of the heart, according to the degree of contraction and the surfaces offered to the passage of the blood. The bellows sound depends chiefly on the increased violent muscular contraction produced by the resistance of the valves, and the rasping sound upon the irregular surface of the valve when there is actual ossification.

Dilatation of the auriculo-ventricular valve produces the same result during the systole as contraction of the semilunar valves—that is, roughening in various degrees of the first or systolic sound, from the strong muscular effort necessary for the heart to free itself of blood; hence this symptom is so frequent in valvular diseases, both at the orifice of the aorta and between the ventricle and auricle.

If the dilatation of the mitral valve be entirely uncomplicated, there is of course no alteration of the second sound of the heart, which is produced strictly by the semilunar valves of the aorta; but if the mitral valve is contracted as well as dilated, there will of course be a double rough sound, although the second sound of the heart will be, properly speaking, unaffected, but often marked by the morbid second sound developed at the mitral valve. It is, however, very rare to find the mitral valve so much diseased—that is, as it were, contracted and dilated at the same time, if we may so speak—without finding the semilunar valves also altered.

The altered second sound is, however, heard very rarely at the mitral valve; generally speaking, it is produced at the aortic valves, and is mistaken for a mitral sound. Dr. Milligan thinks that the

second sound is so moderate from a diseased mitral valve as to be scarcely ever heard, the altered second sound heard in disease of the mitral valve being almost always produced at the aortic.

The rough sound produced by the mitral valve during the act of systole is almost always of the bellows character, although sometimes it may assume various intonations of the rasping sound, resulting from concretions which exist upon the surface of the valve. The rough sound, however, does not measure precisely the severity of the mitral disease; its intensity is so much modified by both the altered force of the heart and the changes which occur in the condition of the blood. For when the blood is much altered, there is a natural tendency to the production of the bellows sound.

The mitral bellows sound is most intensely heard near the apex of the heart, and does not pass into the aorta as the aortic sounds do. Like other morbid sounds of the heart, it may also be heard toward the left axilla or near the scapula, especially when the subject is thin.

The second sound of the heart is much less frequently roughened than the first; it is very often diminished in loudness by the disease of the semilunar valves, but it can only be roughened by their permanent dilatation, allowing the blood to regurgitate into the ventricle in such a way as to produce a harshness of sound. Now, the simple reflux is not, in general, sufficient to produce this, the blood passing back almost noiselessly; it only takes place where there is a rough projection toward the cavity, interrupting the current of blood. Permanent contraction of the auriculo-ventricular valves, especially of the mitral, is sometimes carried to so great a degree as to interrupt the current of blood during the dilatation of the heart; and it then gives rise to a rough sound, replacing the natural second sound, or masking it; this, however, is very rarely met with.

The roughened sounds of valvular disease are not heard over the valves only, but they are conducted by the columnæ carneæ to the muscular portion of the heart; still, they are heard most loudly at a point nearest the valve affected.

Disease of the mitral valve produces an alteration of the sound which is most perceptible near the apex of the heart, very low down, and not so audible near the seat of the valves. It is ob-

vious that attention to the position from which the morbid sound proceeds is the best means of distinguishing between a lesion of the mitral and semilunar valves, as in the latter case the roughened sound is always most perceptible at a much higher situation in the chest, and one which corresponds more nearly with the seat of the valve. The bellows or rasping sound is conducted along the parietes of the heart down to its apex. The position of the morbid sound in disease of the mitral valve is now generally admitted; the first to ascertain the fact was Dr. Pennock, of Philadelphia.

As to the diseases of the valves of the heart, I agree very nearly with Dr. Stokes, that we may determine with sufficient accuracy three forms of valvular disease:—

1. Disease of the mitral valve.
2. Disease of the aortic valve with permanent patency.
3. Disease of the aortic orifice without permanent patency.

Beyond these forms, it is exceedingly difficult, if not positively impossible, to discriminate as to the nature of the disease. In fact, the diseases of the valves of the heart can be summed up in few words.

First. The left side is almost always the only one affected.

Secondly. When either the mitral or the aortic valve is much diseased, the other must necessarily become altered, for the simple reason that the cavity with which they communicate is the same.

Thirdly. When the valves of the heart are affected, the muscular structure will almost invariably become hypertrophied.

The diseases of the valves of the right side of the heart are so rare, and so slightly marked, that my own impression is that it is better for most physicians to pass them over entirely. Obstructions sometimes, but very rarely, occur at the pulmonary valves. When this takes place, Dr. Ormerod (Edinburgh Med. Journal, No. lxv.,) is of opinion that a systolic murmur "not traceable along the aorta, but clearly audible in a line from the third left intercostal space at the edge of the sternum toward the middle of the left clavicle for the distance of two to two and a half inches," will probably have its seat in the pulmonary artery.

Regurgitant disease at the pulmonary valves produces scarcely

any murmur; because although, as I have not infrequently found, the pulmonary valve may be perforated with holes as if by ulceration, yet no sound is produced during the act of regurgitation, because, as Dr. Bellingham states, from the shortness of the pulmonary artery, and the course of its divisions, "the blood does not regurgitate into the right ventricle with sufficient force to develop the murmur."

As to the tricuspid orifice, we may throw out of consideration altogether all contraction, for this scarcely ever occurs. Regurgitation, however, is much more common here, but is usually secondary to mitral contraction on the left side, or sometimes to emphysema of the lungs or bronchitis, resulting from the impediment to the return of blood from the lungs. In these cases pulsation is often visible in the jugular veins, being caused by regurgitation from the right auricle. But the question is whether a distinct regurgitant murmur is present in these cases. I agree with Dr. Bellingham, that, as a general rule, it is not produced from the feebleness of contraction of the right side of the heart. When present, it is near the ensiform cartilage, but is often concealed by the mitral regurgitant murmur, which is frequently heard at the same time.

If several of the valves be simultaneously diseased, and the muscular substance of the heart be at the same time enlarged, the distinction between the first and second sound is in a great measure lost, and there is little more heard than a confused purring: when this occurs there is usually a thrilling sensation perceived by laying the hand on the exterior of the chest. This indicates a grave condition of the heart, constituting one of the most severe forms of disease of this organ, and scarcely ever allows the patient to survive long.

Symptoms. The valvular diseases, like other organic affections, are attended with many painful sensations in the chest. As they are, in general, complicated with disease of the muscular substance of the heart, it is often difficult to say what portion of these symptoms should be ascribed to the valvular, and what to the muscular disease. If the valves are so much diseased as to materially impede the action of the heart, it is reasonable to infer that the pectoral symptoms depend chiefly upon them. If the valvular disorder be

less, the action of the two lesions is a joint one, and it is impossible to separate them.

In some patients, angina pectoris, or a painful stricture of the chest, extending down the left arm, complicates the disease, and may cause intense suffering. In nearly all do we find that violent attacks of dyspnœa follow exercise, or any other stimulants of the action of the heart, or disturbance of the pulmonary circulation. When the heart is calm, the suffering of the patient is very slight, and is often limited to a mere disagreeable sensation in the chest, with occasional attacks of palpitation, which are much more severe when the mitral valve is affected than any other. The complication of acute inflammation of the internal membrane of the heart is by no means infrequent, and will always give rise to considerable pain and great increase of the dyspnœa. Congestions of the lungs are favored by disease of the valves, especially of the left side of the heart, more than by any other lesion of the organ, and are often the chief cause of the violent oppression.

Of the secondary affections, dropsical effusions in the chest and in the cellular tissue generally are the most frequent. It has been previously mentioned that these are confined to no special form of heart disease, but may occur in connection with any of them; most frequently, however, with those which are severe enough to impede the circulation, as one cause of the effusion is certainly the difficult passage of the blood through the cavities of the heart. Some observers have gone so far as to deny the occurrence of cardiac dropsy, except as a consequence of valvular disease: this is clearly erroneous, but the assertion shows that these lesions must, at least, be the most frequent cause of these dropsical effusions.

If the anasarca be not hastened by inflammation of the heart, it takes place rather later, after the disease of the valves has lasted a long time, and the red globules of the blood begin to be deficient. In some cases the effusion occurs first in the serous cavities of the chest, both in the pleura and pericardium; but in the majority of cases anasarca precedes the thoracic dropsy. The face usually first becomes œdematous, then the anasarca shows itself in the hands, and afterwards in the lower extremities. When the patient is pale as well as anasarcous, and his strength materially dimin-

ished, the disease is usually very severe, and approaching to a fatal termination.

The pulse is very often irregular or intermittent when there is disease of the mitral valve, whether it remains patulous during the contraction of the heart, or be in itself so much contracted as to impede the passage of the blood. In disease of the aortic valves, however, the irregularity of the pulse is by no means so constant a symptom, being for the most part confined to those cases in which there is extreme contraction. Sometimes the pulse may be distinctly seen beating in every part of the body; this phenomenon is generally considered as characteristic of aortic regurgitation. I have sometimes, but very rarely, observed a pulsation extending along the veins of the back; this symptom I am of course disposed to attribute to contraction of the tricuspid valve, or to dilatation of the valves of the pulmonary artery, causing the blood to regurgitate in the veins.

The irregularity of the pulse ought not, however, to be in all cases considered a decided sign of disease of the mitral valve. In some individuals the pulse hardly ever beats without some irregularity, throughout the course of a long life; and although in these cases we are apt to find disease of the heart supervening after a certain time, yet we do not usually find it to occur until a comparatively late period. Besides, the intermittence of the pulse at the conclusion of acute diseases, especially in children, is a perfectly well-known symptom. Still, we have not generally in these cases so complete an interruption to the pulsation as is produced by valvular disease; the pulse is decidedly irregular, but at the same time each pulsation is less interrupted than where the valves are obstructed. Hence the pulse is often spoken of as simply intermittent in these cases.

The general aspect of the patient is more characteristic of heart disease when the valves are affected than in any other variety, because the obstruction to the circulation, which gives rise to these symptoms, is the most severe. Hence the bluish tint of the lips, the prominence of the eyes, slight puffiness of the face, and the peculiar physiognomy of cardiac diseases, are most apt to be developed; these are uncertain, but probable indications of the disorder. Congestions and hemorrhages are less apt to occur

when the valvular lesion predominates than when the muscular tissue is hypertrophied, because the blood globules are least altered in the latter case, and congestion therefore often occurs, instead of serous effusions. When the case is one of decided valvular disease, the whole body suffers as in other cases of cardiac disorder, the digestion fails, and emaciation and extreme pallor of the complexion usually follow.

When a patient affected with valvular disease conjoined with hypertrophy is attacked with pneumonia, the case is almost always attended with danger, for the obstruction to the circulation through the lungs is apt to become very great. These congestions are evidently due to the impeded circulation through the heart, and are analogous to those diseases of the liver which are common in the same disorder.

Diagnosis. The diagnosis of valvular diseases cannot be determined with certainty, except by the assistance of physical exploration. We may infer that the valves are diseased if the patient complains of great oppression, and distressing, fatiguing palpitation, and at the same time becomes œdematous; but unless the alterations of the sounds of the heart, characterizing the disease of the valves should be heard, the diagnosis is still uncertain.

The only mode of making a diagnosis with certainty is, of course, careful auscultation, when the characteristic sounds of valvular disease, as already described, may be distinctly heard. We should remember, however, that valvular disease of the heart is so constantly associated with hypertrophy and dilatation, that one can scarcely exist without the other; hence it is nearly always a complicated diagnosis that we have to make out.

Prognosis. The prognosis of the disease is uniformly a grave one, so far as the absolute recovery of the patient is concerned. If the disease occur very late in life, and depend rather upon ossification than upon a cartilaginous deposit, it does not shorten life unless carried to an extreme degree; but when the function of the valves is decidedly interrupted, we have then not only to anticipate a fatal termination, but one much earlier than would be expected in other heart disorders. Death may take place suddenly by an abrupt cessation of the action of the heart, or occur

slowly from the exhaustion and dropsical effusions which follow protracted cases of this disease. Slight lesions of the valves sometimes, however, do not seem to shorten life; the general and physical signs sometimes continue through a long life, especially when the patient is sufficiently at his ease to avoid much muscular exertion.

The following rules for the diagnosis of the valvular disorders are laid down by Dr. Hope and Dr. Pennock, p. 365, (American edition,) and are nearly correct; but there must always remain a share of doubt as to the precise diagnosis of the special lesion of each valve when several of them are simultaneously affected.

"*Signs of disease of the aortic valves.* One of the murmurs above alluded to (either hollow or rasping) is heard during the ventricular contraction (*i.e.* with the first sound) on the sternum, opposite to the lower margin of the third rib, and thence for about two inches or more upward, along the course of the ascending aorta toward the right; and it is louder in these situations than below the level of the valves. Its pitch or key is usually that of a whispered *r*, from being superficial, and it accordingly conveys the idea of being pretty near to the ear.. When a murmur of this kind is considerably louder along the tract of the ascending aorta than opposite to its valves, and is, at the same time, unusually near sounding and superficial—in other words, on a higher key than a whispered *r*, it proceeds from disease of the ascending aorta itself. As the murmur from this cause is audible in the situation of the valves, it might lead to the supposition that they also were diseased, and it is sometimes very difficult to ascertain positively that they are not. That a murmur is seated in the aorta, and not in the pulmonary artery, may be known by its being inaudible or very indistinct high up the course of the pulmonary artery, while it is distinct high up that of the aorta. That a murmur is seated in the aorta or its valves, and not in the auricular valves, may be known by its sounding loud and *near* above the aortic valves, where an auricular murmur, if audible at all, sounds feeble, *remote*, and on a low key, like a whispered *who*.

"When there is regurgitation through the permanently open aortic valves, a murmur accompanies the second sound, and its source may be known by the following circumstances: 1. It is

louder and more superficial opposite to and above the aortic valves than about the apex of the heart, by which it is distinguished from a murmur in the auricular valves with the second sound. 2. It is louder along the course of the ascending aorta than along that of the pulmonary artery, and down the tract of the left ventricle, than down that of the right; by which circumstances its seat is known to be in the aortic, and not in the pulmonic valves. This inference is strongly corroborated by the state of the pulse, which, when the aortic regurgitation is at all considerable, is singularly and pre-eminently jerking—the pulse of unfilled arteries. 3. It is distinguished from a systolic murmur in the aortic orifice by its accompanying the second sound; by its being more audible (though with a gradual diminution) down the course of the ventricle than a systolic murmur; by its being prolonged through the whole interval of repose, and even through accidental intermissions of the ventricular contraction; and by the weakness of the refluent current always imparting to it the softness of the bellows murmur, an inferior degree of loudness, and a lower key, like whispering the word *awe* during inspiration. It often becomes musical.

"[The duration of the murmur in the second sound produced by the regurgitation of blood through the aortic orifice will depend upon the facility of closure of the aortic semilunar valves. If the obstructive disease be slight, so that the valves soon close by the recoil of the arterial column upon them, but a slight jet of blood will pass between their edges. The murmur thereby produced is represented by Williams by the articulate symbol of *trrht*, or *tzzt* (instead of *dup*.) Should the valve remain permanently open, the abnormal sound from regurgitation, instead of being of short duration, may continue during the whole period of the diastole.—P.]"

"*Signs of disease of the mitral valves.* When the valve is permanently open, admitting of regurgitation, the first sound is attended with a murmur. It may be rough (rasping) or smooth (bellows-murmur,) according to the nature of the contraction, [the force of the circulation and the character of the blood,] etc., (p. 107.) Its key is low,—more or less like whispering *who*, (p. 110;) yet it sounds loud and *near* if explored about the apex

of the heart, and a little to the sternal side of the nipple. It may thus be easily distinguished from a direct semilunar murmur, which in this low situation always sounds feeble and *distant*. The murmur in some cases completely drowns the natural first sound on the left side: in others, the sound can be distinguished at the commencement of the murmur.

"I have found perceptible purring tremor to be produced more frequently by regurgitation through the mitral valve than by any other valvular lesion—especially when the ventricle was hypertrophous and dilated, by which the refluent current was rendered stronger.

"If the regurgitation be considerable, but not otherwise, the pulse is more or less small, weak, intermittent, irregular and unequal, (p. 359;) and this, even though the impulse of the heart be violent.

"When the mitral valve is considerably contracted, a murmur (best heard in the same situation as the murmur from regurgitation, and distinguishable in the same way from semilunar murmurs) attends the ventricular diastole and second sound. From the weakness, however, of the diastolic current out of the auricle, the murmur is always very feeble, soft like the bellows sound, and usually on a rather lower key than a whispered *who*, (p. 110.) I have found this murmur absent unless the contraction of the valve was considerable; for the blood had still sufficient room to pass with tranquillity: and I have also found it absent when the contraction was *great*—when, for instance, the aperture admitted one finger only, or merely a quill, provided the current was preternaturally weakened by softening, by extreme dilatation of the heart, or by both. In such cases, however, the mitral disease would not be overlooked, as there is almost invariably a murmur from regurgitation. On the whole, this murmur is exceedingly rare, though Laennec, and authors in general, have supposed quite the contrary, from mistaking for it the murmur of aortic regurgitation, (see p. 103.)

"I have never known purring tremor accompany a diastolic mitral murmur, the current being too feeble to produce it.

"When the contraction of the mitral valve is great, the pulse (whether there be regurgitation or not) is more or less small,

weak, intermittent, irregular, and unequal, in consequence of the supply of blood to the left ventricle being insufficient and irregular, (p. 359.) I have known the same to be occasioned by a polypus choking up the left auricle."

The pulmonary valves are scarcely ever thickened; they are not unfrequently dilated, however, from partial distention or yielding of the tissue. In these cases, we cannot readily make more than a merely probable diagnosis, from the sounds running nearer to the ear than if produced by the aorta.

The lesions of the tricuspid valves are so rare, and the difficulty of diagnosis so great, that Dr. Hope very properly cautions practitioners against attempting a positive diagnosis; with this opinion, we need not say, that we fully agree.

Age. The age of patients affected with valvular disease is exceedingly variable. It may occur from the time of birth to advanced life; sometimes it is met with from the moment of birth, and of course is then evidently an altered conformation which generally becomes permanent. When disease of the valves occurs in young subjects, it usually results immediately from endocarditis; and the same rule holds good also in the majority of young adults. In persons advanced in life, however, some variety of valvular disease is almost necessarily present—that is, the valves are sure to contain cartilaginous deposits, and besides, frequently present bony degenerations. The latter alteration, however, is not in most cases serious, unless the bony deposit should be exceedingly great, when death is apt to occur, sometimes suddenly. This sudden termination of life may also be met with in any case of valvular disease of the heart.

Sex. Valvular disease of the heart is more commonly met with in the male than in the female sex, bearing very nearly the same proportions as rheumatic inflammation in men does to that in women.

Treatment. The treatment is necessarily purely palliative; it is therefore totally different from endocarditis, in which directly curative means are to be looked for. Our object is to prevent, as far as possible, the frequent return of the fits of palpitation and dyspnœa, and to check the further increase of the morbid deposits. A little knowledge of the usual causes of the paroxysms

is soon acquired by the patient, and will in general prevent him from needlessly exposing himself to them. He must learn to lead a quiet, unexcited life, and if his temper be placid, a simple attention to hygienic rules will often effect something very nearly approaching a cure—that is, if the disease be not excessive. Many individuals, however, are unfortunately so situated in life, and are of such temperaments, that it is scarcely possible for them to avoid a renewal of the attacks of dyspnœa; hence the disease is hastened in its progress by causes which are not inherent in it.

When the attacks occur and cause great oppression, nearly the same treatment should be adopted as in other cases of irregular action of the heart. There is, however, rarely occasion for bloodletting; nor, indeed, are there many cases in which it would not be positively injurious; for, as the pallor of the blood is extremely apt to follow protracted valvular disease, we should carefully abstain from any treatment at all fitted to hasten this change. Cupping is very useful where a recent attack of cardiac inflammation supervenes; but under other circumstances it is unnecessary. Complete repose, sinapisms on the chest, and revulsive pediluvia, are highly beneficial, and are often sufficient to relieve the attack.

As internal remedies, Hoffman's anodyne, with a few drops of the aromatic spirit of ammonia, in the proportion of half a drachm of the former to fifteen drops of the latter, is one of the best means of quieting the action of the heart and of gently stimulating the capillary circulation. Assafœtida, with other similar antispasmodics, such as from three to five grains of camphor and two or three of Dover's powder, every two or three hours, are often useful. Often, when the attack is passing off, digitalis may be advantageously administered, either alone, or, as is still better, combined with assafœtida, or Hoffman's anodyne.

The principles of treatment are, therefore, plain enough, and, so far as our means extend, they will be found efficacious; unfortunately we are soon arrested in their administration. But as the most severe organic disorders of the heart do not necessarily shorten life if the organ is not thrown into violent action, the case

is not always attended with such imminent danger as might at first be supposed. The best test of an approaching termination is the condition of the capillary circulation.

There are several organic affections of the heart which are rarely met with, and never present symptoms sufficiently well defined for us to recognize them; hence, they rather belong to pathological anatomy than to pathology, properly so called. Among these are ulcers of the substance of the heart, gangrene of its tissue, pouch-like aneurisms formed by digital cavities beginning at the heart and ending in short cul-de-sacs at a little distance from it. To the practical student of disease they are, therefore, not of more interest than suppuration of the muscular tissue of the heart, which is extremely rare, and not susceptible of recognition.

Atrophy of the heart is a frequent consecutive disorder—that is, it often accompanies cases of phthisis and other disorders attended with great emaciation, in which the heart participates like other organs of the body. Softening of the tissue of the heart is also but a part of general softening of the muscular system; it takes place in cachectic conditions of the system, in which the blood is more or less altered, especially in low forms of fever. The softening diminishes the force of impulsion of the heart; and auscultation is, under these circumstances, a good means of estimating the extent and development of the lesion. Cases in which the heart becomes softened bear and often require the liberal use of stimulants; hence, in a therapeutic view, it is often important to ascertain when this condition exists.

CHAPTER XXIII.

FUNCTIONAL DISEASES OF THE HEART—PALPITATION—PAIN—INTERMITTENCE—ANGINA PECTORIS.

THESE are extremely frequent, and, strange to say, often appear more severe to the subjects of them than the organic alterations. They are usually connected with an excitable nervous temperament, which renders the sufferer irritable, watchful of slight sensations, and apt to complain of the least aberration from the healthy condition: organic diseases of the heart, on the other hand, acquire new intensity, and are doubly distressing to the patient if a functional disorder be added to the organic lesion. The functional disturbance of the heart is extremely protean in its character; sometimes it is not sufficiently defined to admit of classification as a distinct symptom or group of symptoms; at other times the nervous disorder is perfectly well marked, and retains its characters for a long period. As a general rule, we apply the term nervous disorder to many different states. The principal are:—

1. *Palpitation.* This may be, as mentioned, a sign of a true organic disease; but when it is really most troublesome, it is often not connected with a permanent lesion. In these cases it occurs suddenly, chiefly from mental impressions, or other causes, acting directly upon the nervous system. It is most violent when dependent upon anæmia, which is, of course, readily recognized by the pallor and general aspect of the patient. Violent exercise will produce the palpitation as much as it does in those cases which are dependent upon organic disease, but to a much less degree than moral causes. The tendency to palpitation is congenital with some individuals, and may last through a long life without the development of positive cardiac lesions. Nervous

palpitations are readily excited by stimulants acting directly upon the spinal axis, as excess of tobacco, coffee, and sometimes of venery: disorders of the stomach, temporary indigestions, etc., are all capable of bringing on violent attacks of palpitation, which cease soon after the immediate cause. These attacks come on frequently at night, when the patient is often kept awake by them for a long period; and the extreme distress they then occasion constitutes one of the most unpleasant forms of cardiac disease; they are thus usually connected with great disorders of the whole nervous system. Excesses in the use of tobacco have more influence than any single cause in producing this peculiar variety.

If the ear be applied to the chest of a patient laboring under nervous palpitations, the two sounds are quite distinct: the second rather sharper than usual, and the first has occasionally more or less of the bellows character, especially if the patient be anæmic. The impulsion of the heart is quick and decided, but there is no positive increase of force, no sensation similar to that of a large body striking against the walls of the chest, which is one of the best indications of hypertrophy.

Attention to the difference of character in the impulsion of the heart met with in cases of functional disease and hypertrophy should be carefully observed. When the patient is laboring under functional disorder, the bellows sound has usually more of a musical intonation, and at the same time is less loud and decided than in cases of organic disease. Thus a little attention will generally enable one to distinguish between these two varieties of sounds.

2. *Pain* in the heart and near it, is frequently a purely nervous symptom. It has been already stated that this, when acute, is more frequently a mere nervous sensation than a sign of organic disease. It is in some cases a pure neuralgia, sharp and lancinating, and extending from the spine to the neighborhood of the heart, or along the ribs and to the epigastrium. Sometimes it alternates with pain at the latter situation, or with other disagreeable sensations. In other instances there is general soreness about a large portion of the chest, especially in the neighborhood of the heart. In other cases, again, it is a mere neuralgic pain, limited to the region of the heart itself, and often described as to

a great degree peculiar. Sometimes it gives the patient a sensation as of an auger driven through the chest; at other times it is like that of a sharp instrument. Occasionally it is a mere consciousness of the action of the heart, to a greater degree than exists in healthy individuals; this, however, is not confined to functional diseases of the heart, but exists also in organic disorders. The only difference between them is, that the one or the other variety of disagreeable sensation occurs under precisely opposite circumstances. Thus rest, which to a great degree quiets nervous sensations, will usually increase that which depends upon mere functional disorder; the converse of this is also true. All, or any of these sensations, may coincide with positive organic disease, but not necessarily so; they may be perfectly independent of it, and of no real danger, although causing extreme annoyance to the patient.

3. *Intermittence.* Irregularity of the pulse is, as was before mentioned, both a functional and an organic symptom. It may exist throughout a long life without the development of any organic lesion. In some persons the symptoms assume an extreme intensity, and may amount to positive syncope—the patient fainting under slight impressions—totally inadequate, under ordinary circumstances, to produce such a result. This condition, like the other symptoms alluded to, may occur as a mere attendant upon organic disease, but it is more frequently a purely nervous symptom.

4. *Angina pectoris* is ranked in most works as a separate disease—that is, as having a definite train of symptoms capable of being separated from other affections of the heart. This view of the subject is not, however, at present regarded as the most tenable one; on the contrary, the group of symptoms called angina pectoris is understood to depend upon a functional disease of the heart allied closely to gout, or upon various organic lesions, especially ossification of the valves, which is often dependent upon a gouty more than upon a rheumatic diathesis. The symptom, it is well known, consists in an intense feeling of dyspnœa, with pain extending down the arms, usually the left arm only. The dyspnœa comes on very suddenly in most instances, usually after some excitement of a mental kind, or after active bodily exertion.

If the attack be extremely severe, death may occur during the paroxysm; but in most cases the attack passes off in a few minutes, leaving the patient comparatively well after intense suffering. The extension of the pain down the left arm is one of the most remarkable features of the disorder; the same symptom may occur when there is pain of a mere neuralgic character, but then it is comparatively slight.

Angina pectoris is most readily relieved by diffusible stimulants, as Hoffman's anodyne, ether, and the like. The usual revulsives to the spine and anterior part of the chest, which relieve so many of the neuralgic diseases of this cavity, are also of great benefit. The principal object of our treatment, however, is certainly to prevent the recurrence of the symptoms; to effect this object, it must be directed to the removal of the cause. The organic affection on which it commonly depends is, unfortunately, incurable in the majority of cases; but a careful attention to the exciting causes of the disease will exercise at least some control over the recurrence of the paroxysms.

Although no one treatment can be adopted in the management of functional disorders of the heart, nevertheless certain general indications are well settled. If functional disease is not connected with organic, a debilitating treatment is injurious; the best means are the application of counter-irritants, especially of the milder revulsives, such as repeated weak sinapisms, frictions with hot salt and the like, from time to time. When there is a sharp pain at the heart, small blisters, frequently reapplied, will remove it sooner than almost any other remedy: the deeper counter-irritants, as tartar emetic, issues, and setons, do not seem so well fitted for these cases as those whose action is more diffused, but more equable. Among the internal remedies suitable for those cases in which tonics are necessary, the infusion of the wild-cherry is one of the most agreeable to the stomach, at the same time that it exerts a directly calming action upon the irritability of the heart; in no disease is this remedy of so decided benefit as in cases of nervous palpitation connected with feebleness of the system. Chalybeates are not necessary, and scarcely useful, except in palpitations dependent upon anæmia, especially if occurring in chlorotic girls.

Assafœtida and Hoffman's anodyne, and camphor if given in doses of three to five grains three or four times daily, answer very well in certain cases of nervous disorder. A careful avoidance of excesses of all kinds, night watching, all stimulating drinks, including tea and coffee, and of tobacco, will often suffice to cure a nervous disorder. A change of residence, and the abandonment for a time of an absorbing occupation; the removal, if possible, of mental causes of uneasiness, with gentle exercise, country residence, and simple nourishing diet, are in severe cases indispensable. Marriage is often followed by a complete removal of the symptoms, much to the surprise of the patients, who are apt to be much more uneasy on account of mere nervous palpitation than of real organic lesion.

CHAPTER XXIV.

DISEASES OF THE AORTA—AORTITIS—ANATOMICAL CHARACTERS—SYMPTOMS—DIAGNOSIS—PROGNOSIS—TREATMENT.

INFLAMMATION of the aorta has been scarcely studied, except of late years; but it is now known that, although rare, it is a disease occasionally met with. The aorta participates in the liability to inflammation which is so characteristic of the red blood cavities of the heart. In many instances the inflammation merely extends from the left ventricle downward into the aorta, and the disease remains the same, but a larger portion of the arterial tissue is affected than in cases of endocarditis, where the heart alone is inflamed.

Anatomical characters. The anatomical characters of the affection are less decided even than those of endocarditis; for the force of the current of blood is greater, and, of course, the lymph which is thrown out during the inflammation adheres with more difficulty to the membrane. There is the usual redness of inflammation, not regularly diffused over the membrane, as in cases of mere cadaveric redness from imbibition, but shaded in different degrees of intensity, and in irregular patches; like the other signs of inflammation, it is most evident about the arch of the aorta, where the disease is earliest developed. The redness sometimes allows the minute vessels and fine dots of which it is composed to be distinctly traced; in other cases they are confounded with the general shading.

The lymph, in part, adheres to the membrane—that is, those portions of it which are early organized, and form, as it were, a continuous whole with it; sometimes there are granulations and irregular vegetations, as in cases of endocarditis; they arise merely from the irregular deposition of the lymph. In a few

rare cases ulcers are developed at the bottom of the deposits of lymph, and the internal membrane is afterwards gradually removed by the ulceration; but they are not common, except in the more chronic forms of the disorder, when cartilaginous matter has replaced the original secretion of lymph, and ulceration takes place below it.

All the coats of the aorta are in some cases thickened. The internal membrane is in bad cases softened, and is often of a dull yellowish tint; a condition which indicates an approach to gangrene. I have seen these patches of softened tissue extend throughout the greater part of the aorta; but in most instances they are confined to the arch of the aorta and the thoracic portion. The products of inflammation are therefore nearly similar in inflammation of the lining membrane of the aorta and of the left ventricle; but as the office of the artery is simply to serve as a channel for the blood, instead of being an active propelling power like the heart, the distress produced by arteritis is less considerable.

Symptoms. The symptoms of aortitis are often very obscure. In many cases there is unusual uneasiness deep in the chest, rarely amounting to defined pain; it is often a mere sense of oppression, or of extreme dyspnœa; these symptoms, however, vary to a great degree, and though scarcely ever totally absent, are sometimes so badly defined that they almost escape the attention of the physician, and are, at least, badly described by the patient. In some cases the orthopnœa is quite as intolerable as in any other affection of the chest; but this is not the case with the majority of patients.

The palpitations are at times perceptible by the patient, but not as a general rule; the impulse of the aorta may usually be felt by pressing the finger behind the top of the sternum; and by applying the stethoscope or the ear upon the upper third of the sternum the impulsion is quite distinct. The circulation is nearly always more or less disturbed; few patients escape entirely without fever; in some the fever is very intense, and one of the most marked symptoms of the affection; and though not always a well-developed symptom it is so in many instances. The heart itself participates in the affection, and the impulsion

is often nearly as strong as that of the aorta, but is chiefly in cases more or less complicated with inflammation of its lining membrane.

Cough and expectoration scarcely belong to inflammation of the aorta; the former may exist in a slight degree, but the symptoms rather belong to some associated affection of the lungs than to the inflammation of the aorta. As in all cases of fever, many secondary symptoms, such as loss of appetite, cephalalgia, and constipation, may accompany aortitis, and if the abdominal aorta be inflamed, some local uneasiness, corresponding to this part, may be felt; but as the symptoms are not at all peculiar, and are very irregular, little attention is generally given to them.

Besides the mere increase of impulsion, a sawing sound—that is, the double rasping sound, may often be heard distinctly at the upper portion of the sternum; one part of the sound corresponding with the onward motion of the blood, and another with the partial reflux which seems to occur in those cases, from what cause would be easy to imagine, but difficult to prove. This sign, however, is chiefly heard when the inflammation has produced a partial disorganization of the coats of the artery, if not amounting to aneurism, at least to thickening.

The termination of a case of aortitis is of course various; the large majority of cases recover, but if the aortitis occur as secondary to some other disease, or if it be very violent, either from unusual extent or peculiar constitution of the patient, it may be fatal at a very early period. Like endocarditis, it may terminate in recovery from the acute period; but thickening of the aorta, cartilaginous deposits, and other alterations, may remain long after the cessation of the febrile excitement, and at last terminate in aneurism, from the giving way of the weakened internal coat.

Diagnosis. The diagnosis of the disease is in many cases involved in much difficulty. As the pain is extremely irregular, at times quite insignificant, at others severe, but generally not limited to a particular portion of the chest, and not accurately corresponding with the position of the aorta, it is of little value as a diagnostic sign, unless it is seated at the upper part of the sternum—that is, very near the arch. The fever and disturbance of

the circulation are of much value if conjoined with strong throbbing, or a sawing sound in the region of the arch. In some cases there is serous effusion throughout the body as in other cases of disease of the circulation. Lastly, we have negative signs as regards most other affections of the heart or lungs capable of producing analogous symptoms; hence the diagnosis, by way of exclusion, is then of great assistance to us. If, however, the heart or lungs be affected at the same time with the aorta, we can only rely upon the positive indications of aortitis, few as they may be, and the diagnosis is therefore often uncertain. A careful examination of the symptoms added to an estimate of their relative value will, however, generally make the case clear.

We must remember, in making the diagnosis of aortitis, that it often occurs in connection with endocarditis. Hence those cases are usually considered as simply cardiac inflammation, which is indeed the more serious disorder of the two. Still we may sometimes even determine those cases which are connected with cardiac inflammation, by the greater roughness of sound extending along the course of the aorta. Where the heart is not at the same time inflamed, we can often make out the characters of the disease with comparative readiness, by attending to the rough impulsion of the blood through the arteries, together with, frequently, dropsical effusion. I do not, however, consider it always possible to make a certain diagnosis.

Prognosis. The prognosis is in general not unfavorable. If the dyspnœa be very violent and does not yield to blood-letting, it is an unfavorable sign; lividity of the countenance, and large serous effusions throughout the body, are among the worst symptoms. When aortitis occurs in persons much enfeebled, or suffering under previous disease, it is always severe, and the prognosis must then be regarded as most unfavorable.

Treatment. The treatment is, of course, decidedly antiphlogistic. If the affection be discovered at an early period, full blood-letting is, of course, the best means of subduing the inflammation, and of removing the condition of the blood which accompanies it. It may be necessary to repeat the bleeding more than once. Leeches above the sternum approach very near the arch of the aorta, and produce a much more decided influence than we

could suppose would be the case. The usual antiphlogistic treatment must accompany the depletion—antimony in small doses, opium and ipecacuanha, mercurials—and, finally, when the inflammation has almost subsided, digitalis is indicated in the declining stages of the disease, and must be administered according to the usual rules on this subject. Absolute rest should be insisted upon for a long period, and the diet should be as simple and as light as possible.

Both aortitis and endocarditis are sometimes associated with acute or inflammatory phthisis, and the tuberculous disease may be at first overlooked, or not developed until the excitement of the circulation diminishes. The treatment of such a complication does not offer anything peculiar in its character; after the subsidence of the acute symptoms, however, the patient must be watched with great care for a considerable period.

CHAPTER XXV.

ANEURISM OF THE AORTA—ANATOMICAL CHARACTERS—SYMPTOMS—DIAGNOSIS—PROGNOSIS—TREATMENT.

ONE of the terminations of aortitis is in aneurism, especially of the arch; this usually supervenes on the giving way of the internal membrane, so that the blood passes between it and the middle coat; in some rare instances the blood finds its way for a long distance between the two coats, constituting a variety of dissecting aneurism; this is, however, an exception. Although aneurism of any portion of the aorta is regarded as a strictly medical disease, yet that of the thoracic portion alone belongs to our present subject, and in the majority of cases will be found to depend directly upon inflammation and softening of the internal coat. In some cases, however, the influence of inflammatory action either cannot be traced at all, or so remotely that the cause becomes at last doubtful; this is especially the case with persons much advanced in life, whose aorta is studded with bony and cartilaginous plates, the origin of which, in a good proportion of cases, we have every reason to believe inflammatory, like that of the same deposits in the internal membrane of the heart.

The simple distention of the aorta from the stretching of all its coats is by no means infrequent at the arch; it never reaches the size observed in false aneurism, and unless it should afterwards be converted into the latter variety does not, as a general rule, endanger the life of the patient.

Anatomical characters. The anatomical characters of aneurism of the aorta are so well known as scarcely to require a complete description. In the variety termed true aneurism, the aorta reaches various degrees of distention, with thickening of its coats; the openings of the arteries leading from the arch are occasionally

much contracted, so as to admit with difficulty the passage of the blood: in one case I have seen the current of the blood diverted from the three arteries of the arch and turned into collateral channels; in this case there was no pulsation perceptible at the wrist. If the aneurism be large enough the trachea is often pressed upon, and the respiration becomes difficult. The heart may remain in the healthy condition, or may participate in the original inflammation and the results of it. When diseased, it generally presents the traces of previous endocarditis, and various degrees of thickening and other alterations of the lining membrane.

In the variety which is much more common, and is sometimes styled false aneurism, the appearances on dissection are similar to those so fully described in surgical works that it is not necessary to enter into a minute description. The internal membrane gives way from softening and ulceration, resulting from the atheromatous deposit which has removed the internal coat of the aorta, and the blood percolates through the opening. The lining membrane is gradually absorbed as the aneurismal tumor enlarges, while a portion of the sac is gradually filled with fibrin, which is deposited in layers, until it forms a mass which may attain a very large size. The blood passes by the side of, or through an opening in the fibrinous mass, which is irregular in size and more or less obstructed, so that a smooth passage is no longer left for it. The disease terminates in two ways: by the gradual pressure upon the trachea and lungs, producing disorder of these organs; and by rupture of the tumor, causing sudden death from hemorrhage. In a few cases death may follow from paralysis, caused by the caries of the spinal column.

Absorption of the bones of the chest always takes place if the tumor comes in contact with them; they may be the sternum and the anterior portions of the ribs, or the bodies of the vertebræ, if the tumor happens to enlarge in that direction. If the anterior parts of the chest are absorbed, a tumor forms which sometimes yields a distinct pulsation, but toward the spine an external pointing of the tumor can scarcely take place. In many instances, death does not result from the aneurism, but the patient is carried off by some accidental disease not immediately connected with the lesion of the aorta.

The natural mode of termination of this disease is death, by rupture of the coats of the aneurism. This may occur in any portion of the chest.

Mr. Crisp, in his work on the diseases of the blood-vessels, has given some interesting statistics as to the locality of the rupture in aortic aneurisms.

Of 175 cases, the terminations of 8 are unknown. Of 98 aneurisms of the ascending aorta, 58 burst into various surrounding cavities or tissues; 30 into the pericardium; 7 caused death from pressure on the bronchi; 6 from serous effusion into the pericardium or pleura, and the others from various causes, mostly, however, from circumstances connected with the aneurism itself.

Of 48 aneurisms of the arch, 20 were ruptured into the surrounding tissues, only one externally; 12 caused death, as was supposed, by pressing on the trachea and bronchi; the others by various accidents due to the aneurism—such as hæmoptysis. A few of the cases terminated fatally by incidental circumstances.

Of 21 aneurisms of the descending aorta, 16 proved fatal by rupture; the others from various causes, chiefly connected with the obstruction to the circulation.

Physical signs. Aneurism of the aorta is recognized mainly by the physical signs—those connected with the obstruction to the passage of the blood, and lastly, the secondary effects produced by the immediate pressure, or the obstruction of the circulation upon other organs. The growth of the aneurism itself is attended with little or no pain; for the aorta, when attacked by chronic disease, is scarcely susceptible of painful sensations. The physical signs at first are limited to a strong pulsation at the arch of the aorta when the aneurism is seated there, which may be felt by pressing the finger downward behind the top of the sternum, or may be recognized by applying the ear or the stethoscope at the upper part of the sternum. It is also frequently distinctly felt behind each clavicle, but is more marked on one side or the other, according to the situation of the aneurism.

The percussion is affected to so slight a degree at the commencement of aneurism that it is not a sign of much value; but as the lesion increases in size, we often find that the sound becomes dull over a considerable extent at the upper third, or even

half of the sternum. The dullness of percussion is usually most marked on the right side of the sternum, as the tumor generally passes most to that side of the chest from the situation of the aorta at its origin. Sometimes, when the aneurism is very large, the dullness extends on one side or the other of the sternum, according to the situation of the tumor. The pulsation usually increases in force, but not invariably, for the current of blood is not always propelled in such a way as to strike forcibly against the sternum.

In most cases, too, there is a very evident *bruit de scie*, or sawing sound; this is perceptible both in the first and second sound, being caused by the partial reflux of the blood, and is easily distinguished from the simpler rasping sound heard at the region of the heart. With these sounds there is often a decided thrill. It would be very easy to recognize aneurism of the aorta if all these signs were present in every case, but this is not so; the only permanent one is the dull percussion, and even that is sometimes difficult to recognize if the aorta enlarges on its posterior, and not its anterior surface. But although the signs are often obscure, they are rarely altogether absent, and with attention may generally be detected from time to time, the percussion being always permanently dull.

When the aneurism is seated at the upper part of the arch, the tumor may be felt by passing the finger behind the sternum; this is an almost invariable test in cases where the aneurism has attained a certain size. When it is small, and seated at the lower portion of the thoracic aorta, there is of course no tumor, and but little thrill is communicated to that spot. It is especially in aneurisms of the arch that the swelling can be felt behind the sternum.

If the aneurism produces a tumor external to the chest, the rough, double sound may be heard distinctly by placing the ear upon it. This sound is rarely entirely lost, except in cases in which the aneurismal mass is filled up by coagula, leaving the main channel of the artery free. Sometimes a double impulse is perceptible to the hand also in these cases.

Symptoms. The general symptoms are in some cases almost as imperfect as the physical signs. Those most directly connected

with the aneurism are the disturbance of the circulation, both at the heart and in the arteries. The pulse is in some cases thrilling, which is almost a pathognomonic symptom when present in a well-marked degree of aneurism, but it is often quite regular and natural, even in cases in which the aneurismal tumor is large, but is not so formed as to obstruct the passage of the blood. The uneasiness in the chest is at times very slight, but when the trachea is pressed upon, the dyspnœa becomes extreme, and a convulsive cough occurs in paroxysms, having some resemblance to attacks of pertussis. The pain in the chest is often neuralgic, from pressure on the sides of the dorsal vertebræ; and from the same cause, instead of being confined to the thorax, it may extend throughout a large portion of the body.

Sometimes there is a considerable degree of stridor in the respiration, which is mentioned by Morgagni as a symptom of aneurism of the aorta compressing the trachea. And, as Dr. Stokes states, it is heard more below than above; thus, if the ear be placed upon the trachea, the seat of it could be distinguished from that which occurs in laryngitis.

In other cases there is a considerable degree of wheezing in the respiration, also due to aneurism; this is heard at a distance from the patient, and is of course produced by pressure upon the bronchi.

The same circumstance—that is, pressure—occasionally gives rise to difficulty in swallowing.

The pulse is also frequently to a certain degree peculiar in cases of aneurism. In a case which terminated fatally under my care at the Philadelphia Almshouse Hospital, many years ago, there was almost entire absence of pulsation at either wrist; a very faint pulse being felt only on the right side. In like manner there was scarcely any pulsation perceptible in the carotid arteries. The cause of this absence was afterwards found to be the almost complete obliteration of the large arteries springing from the arch, the circulation being kept up almost entirely by the intercostal arteries, which were enormously dilated. This case, which was frequently observed by both Dr. Pennock and myself, was, so far as I know, unique. In ordinary cases of aneurism, however, the pulse is to a certain degree irregular, and

feeble, generally more so on one side than on the other; Dr. Bellingham remarks that it is more frequently irregular on the left than on the right side, owing to the longer course of the left subclavian within the thorax.

The effects of pressure on the neighboring organs are so various that all the viscera in the thorax may be involved; so that the diagnosis of the disease is thus rendered much more obscure in consequence of the secondary disturbance of the organs which are not immediately connected with the heart. They are therefore of little diagnostic value, except as connected with some local indications of aortic disease. The other organs than those of the chest are not directly connected with the enlargement of the aorta, and sympathize only as the disorder of the circulation extends itself throughout the system.

Diagnosis. The diagnosis of aortic aneurism, it is plain from the symptoms, must often be difficult. If the disease be so far advanced, and so near the surface as to produce all its physical signs, then the diagnosis is plain enough. Sometimes groups of enlarged lymphatic ganglia and induration of the anterior portion of the lung may give rise to signs not very dissimilar to those of aneurism. If the tumor has perforated the bony parietes of the chest, the diagnosis is, of course, evident enough. But it is most essential to recognize the disease at an earlier stage, when there are as yet no strongly-marked signs. The diagnosis is then mainly founded on that nice balancing of slight symptoms which we term medical tact; hence the presence of any of the physical signs of aneurism, with some of the local symptoms, such as dyspnœa, pain, etc., will make us sure of the existence of the disease, provided no indications of other lesion of lungs or heart, which could explain the symptoms, are found. If the aneurism be complicated with other thoracic diseases, then our diagnosis by exclusion fails us, and we must trust mainly to the direct signs, and then examine whether the symptoms are not more connected with a lesion of the circulation than of the lungs. If we ascertain that the seat of the disease is the heart and aorta, but not the lungs, there is little further difficulty in settling the diagnosis as one of aneurism, either simple or complicated with heart disease.

Termination and prognosis. The termination of this disease

is almost necessarily fatal—that is, the disease is at least practically incurable, but the patient may live for a long series of years, and at last die of a disease not connected with aneurism. This is very often the course of the disease if the patient be of a quiet, placid turn of mind, and be placed in such situations of life as to free him from anxiety or laborious exertions.

Treatment. In a disease of this nature the treatment is obviously palliative. When an aneurism is once fairly formed we possess no means capable of curing it; all that we can attempt to do is, to prevent, as far as is within our power, the further rupture of the coats of the artery, and to favor the formation of coagula in the sac. The patient should, as he values his life, remain as quiet as possible, if not in a state of absolute repose; he should take no severe exercise, especially none which produces much excitement of the circulation, or requires strong efforts of the muscles of the upper part of the body. The diet should consist of the simplest and least stimulating articles of food, not only because they do not exercise a directly injurious effect on the circulation, but because indigestion and flatulence always increase the severity of the symptoms of diseases of the heart or aorta. Occasionally we may take blood to quiet the circulation, when the heart is driving the blood with extreme force through the aneurismal tumor. The bleeding should not, however, be repeated very often, as there is frequently a disadvantage in taking away large quantities of blood. This doctrine is of course opposed to the old practice of treating aneurism, but I think it is often very evident that frequently-repeated blood-letting is injurious in this disease. The bowels of the patient should be kept regular, although it is not advisable to use large or very powerful doses of purgative medicines.

Digitalis may sometimes be given to quiet the circulation; but this remedy should be used cautiously, for although it produces a diminution of the frequency of the heart's action, yet, at the same time, it may check it to so great a degree as to compromise the life of the patient.

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